CIVIL ENGINEERING

MAY 1954

THE MAGAZINE OF ENGINEERED CONSTRUCTION

480-ton intake pipe section 100 ft long is launched for Contra Costa Steam Plant of Pacific Gas & Electric Co. See article by E. J. Garbarini.

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

. . . the finest structures rest on

RAYMOND FOUNDATIONS

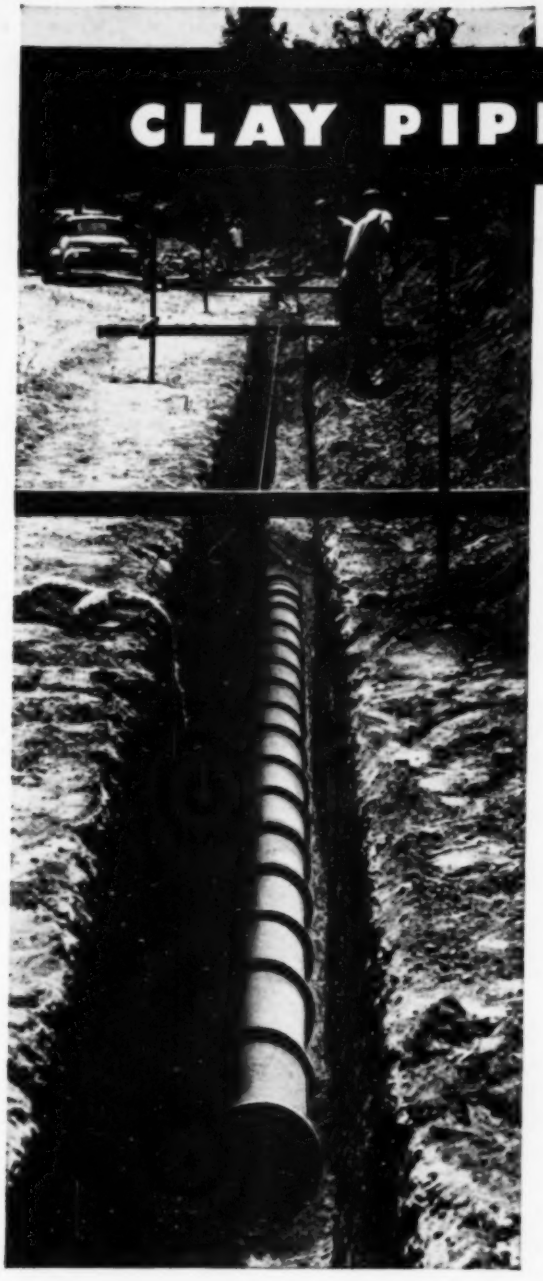
BOK SINGING TOWER
Mountain Lake, Florida

ARCHITECT: Zantzinger, Borie & Medary, Philadelphia

CONTRACTOR: Horace Burrell & Son, Philadelphia

THE SCOPE OF RAYMOND'S ACTIVITIES—Soil Investigations... Foundation Construction . . . Harbor and Waterfront Improvements...Prestressed Concrete Construction . . . Cement-mortar In-place Lining of Water, Oil and Gas Pipelines.

RAYMOND
CONCRETE PILE CO.
140 Cedar Street • New York 6, N.Y.
Branch Offices in the Principal Cities of United States and Central and South America



CLAY PIPE *Specified*

For New Tuscaloosa Municipal Sewer Project

More than 44,000 feet of Vitrified Clay Pipe are being installed to serve a growing residential area in Tuscaloosa, home of the University of Alabama.

Because Clay Pipe proved outstanding over the years in Tuscaloosa sewerage installations, it was again first choice for the current $170,000 sewer expansion program. City engineers throughout the country rely on the dependability and proven performance of Vitrified Clay Pipe for sanitary sewers. It's guaranteed for 50 years!

Clay Pipe is readily available, too. It's *all* clay — an abundant, non-critical material. And it's chemically inert, unaffected by acids, detergents, or wastes from home garbage disposal units. It's the one pipe that *never wears out!*

Vitrified

CLAY

CLAY PIPE NEVER WEARS OUT!

PIPE

NATIONAL CLAY PIPE MANUFACTURERS, INC.

1520 18th St. N. W., Washington 6, D. C.
206 Connally Bldg., Atlanta 3, Ga.
100 N. LaSalle St., Rm. 2100, Chicago 2, Ill.
703 Ninth & Hill Bldg., Los Angeles 15, Calif.
311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio

ESSENTIAL • ECONOMICAL • EVERLASTING

C 253-5

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Table of Contents is on page 25.

May we help?

Solving water problems is our business. Our engineering files contain over 40,000 case histories cross-indexed for easy reference. Whatever your problem—whether it involves sterilization, coagulation, pH control, taste and odor control, or water filtration — %Proportioneers% has the experience and equipment "in stock" to solve it.

%Proportioneers%
Model 47 Chem-O-Feeder
. . . for hypochlorite, alum, soda ash, lime, ferric sulphate.

%Proportioneers% world famous "Little Red Pump"—the Heavy Duty Midget Chlor-O-Feeder. Simple, adaptable, dependable. Recommended for a wide range of water treating applications.

May we help?

. . . send for data and recommendations

to %Proportioneers, Inc.%, 360 Harris Ave., Providence 1, R. I.

% PROPORTIONEERS, INC. %

Technical service representatives in principal cities of the United States, Canada, Mexico, and other foreign countries.

Lithographed on stone for U. S. Pipe and Foundry Co. by John A. Noble, A. N. A.

PIPE LINE CREWS encounter all kinds of conditions from deep woods to the congested streets in the heart of a large city's business district. This cast iron pipe installation could be either a water supply line from a mountain reservoir or a sewer force main leading to a remote treatment plant. If it were a gas transmission line it would, of course, be mechanical joint pipe.

U. S. cast iron pipe in sizes from 2-inch through 24-inch are cast *centrifugally* in metal molds with bell-and-spigot, mechanical joints and plain ends. The *pit cast* process is used in producing all sizes of flexible joint and flange pipe as well as all pipe 30-inch and larger. Highly developed production controls guard the uniformly high quality of U. S. Cast Iron Pipe.

United States Pipe and Foundry Co.,
General Offices, Burlington, N. J.
Plants and Sales Offices Throughout the U. S. A.

U.S.
cast iron
PIPE
FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE

CHICAGO SEWAGE EQUIPMENT

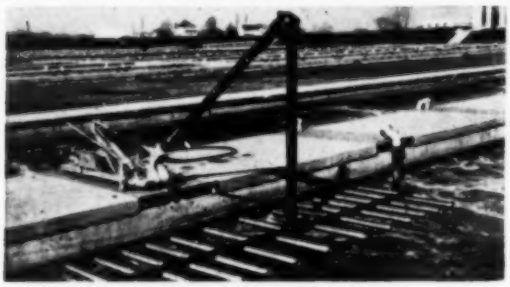
•Dependable

•Economical

•Efficient

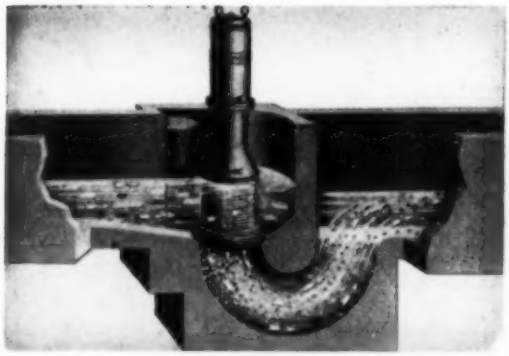
"PAKAGE" SEWAGE PLANTS

A unit specifically developed and planned for small community housing developments or industrial plants. Handles sewage flows from 50 to 500,000 gallons per day in single or multiple units. Excellent for population equivalents from 100 to 5000. No specially trained plant operator required.



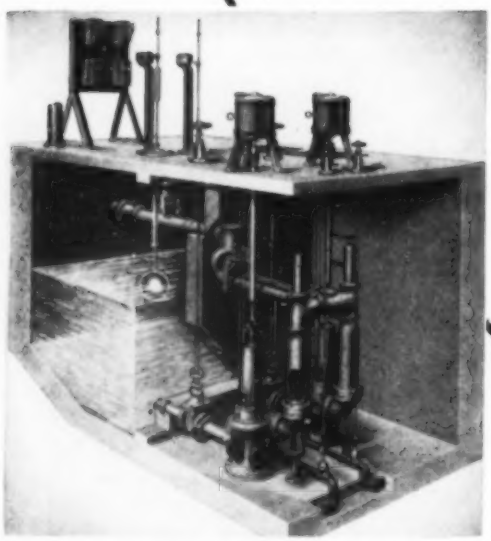
SWING DIFFUSERS AND PRECISION TUBES

Swing Diffusers assure uninterrupted operation without costly stand-by tanks. Individual swing units are easily raised for inspection and diffuser cleaning. Lowest cost simplified cleaning restores new tube performance, permitting maintenance of lower blower pressure. Wide-band air diffusion means no unaerated center core.



COMMINUTOR

Sewage solids are automatically screened and cut without removal from the line of flow by the Comminutor. Eliminates handling, burial or incineration of screenings. No odors, unsightliness or fly nuisance.

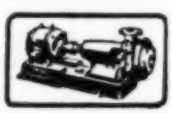


FLUSH-KLEEN SEWAGE EJECTORS

The proven clog-proof pump for handling raw sewage or liquids containing coarse or stringy matter. Incoming sewage flows through idle pumps. Incoming solids are retained on a screen. Screen is backwashed when pump starts — all solids are carried to discharge pipe. Pump handles only strained liquids.

CHICAGO PUMP COMPANY

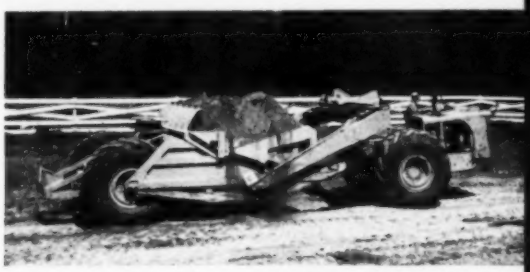
SEWAGE EQUIPMENT DIVISION



622 DIVERSEY PARKWAY CHICAGO 14, ILLINOIS

Faster, easier loading . . . because A-C Motor Scrapers have up to 20 hp. to handle every struck yard . . . plus offset cutting edges and "center-boiling" loading action that spills the dirt evenly, filling corner voids for full capacity loads.

How Allis-Chalmers Motor Scrapers help Cut Cost per Yard by Cutting Time per Yard



High-speed hauling. The power behind the TS-300 teams up with big, traction-type tires that gear it to the road . . . move capacity loads at 22.5 mph. And operating clearance of 20 in. helps keep it from hanging up on rutted haul roads.

Positive, forced ejection . . . eliminates wasteful circling or other time-consuming methods of removing the load. Allis-Chalmers' patented forced-ejection system plus high apron lift *bulldozes* dirt out of the bowl fast every trip . . . without extra wear and tear on power control unit cables and clutches.

Easy operation. From foam rubber seat to finger-tip control, shock-free hydraulic steering and full visibility, a TS-300 operator has every available help for safe, sure, speedy work. Balanced weight distribution and low center of gravity make A-C Motor Scrapers easy to maneuver even at top speed.

A dirt-moving "package" that makes every second count. The powerful HD-20 torque converter tractor is an ideal teammate for the TS-300. It synchronizes to scraper speed at contact . . . automatically loads at fastest speed conditions permit with less strain on operator and equipment . . . gives scraper an extra fast start to the fill.

TS-300 MOTOR SCRAPER
14 cu. yd. struck capacity
18 cu. yd. heaped capacity
280 hp. Buda diesel or
275 hp. Cummins diesel

TS-200 MOTOR SCRAPER
10 cu. yd. struck capacity
13 cu. yd. heaped capacity
176 hp. Buda diesel or
165 hp. Cummins diesel

Your nearby A-C dealer will be glad to give you more yardage-boosting facts about job-tested, *job-proved* Motor Scrapers. He can also tell you where you can see them at work and talk to the men who own and operate them. You owe it to yourself to call or stop in soon.

THE FINEST LINE ON EARTH

ALLIS-CHALMERS
TRACTOR DIVISION—MILWAUKEE 1, U. S. A.

Paved areas made smooth, colorful, resilient with

BITUMULS

WALK-TOP

Economical...Factory-compounded in fast colors... Red, Black or Green. Long-Lasting...Easy to apply

Walk-Top gives a proved, uniform, protective, wear-resistant seal for all types of pavements.

In all parts of the country Paving Contractors and "Hot Plant" operators are now using Walk-Top to satisfy the demand for a smooth, colorful surface that is grit-free, resilient, and weather-proof. They have found that this easy-to-use material—applied cold—offers an economical method of sealing all surfaced areas.

This photograph shows the green walks on Bedloe's Island around the Statue of Liberty

Home-owners are proud of their distinctive "Walk-Top-sealed" driveways

FOR PLAY AREAS

Walk-Top seal is *standard* for thousands of school play areas throughout the country. In San Francisco, for example, over 2,000,000 sq. ft. of school playgrounds, both old and new, have been sealed with Walk-Top in the last two years alone. Other typical applications may be found in Akron, Pittsburgh, Washington, D. C., Providence, Fresno and Cincinnati. School and Park Authorities in these cities and in many others repeatedly specify Walk-Top.

WALKS AND PARKING AREAS*

Walk-Top is used extensively on all types of paving to provide a fast-draining, void-filling seal that is colorful, smooth and resilient.

FOR DRIVEWAYS

Walk-Top, easily applied cold over the old pavement, by brush or squeegee, gives a clean, enduring, colorful seal—at low cost.

WALK-TOP is available through Dealers and Contractor-Distributors throughout the country. Contact our nearest office for information.

WALK-TOP and Play-Yard Binder for Playgrounds—Laykold Wearcoat and Resurfacer for Tennis Courts—standards of quality for over *twenty* years.

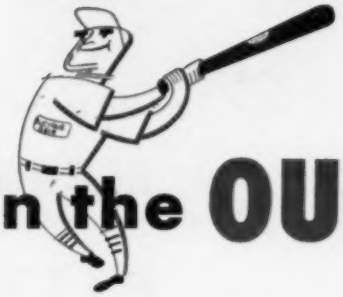
**For oil-resistance ask for Colfix Jet Seal.*

SEND FOR FREE ILLUSTRATED BOOKLETS

AMERICAN Bitumuls & Asphalt COMPANY

E. Providence 14, R. I. Perth Amboy, N. J. Baltimore 3, Md. Mobile, Ala.
Columbus 15, Ohio Tucson, Ariz. Seattle, Wash. Baton Rouge 2, La. St. Louis 17, Mo.
Inglewood, Calif. Oakland 1, Calif. Portland 7, Ore. Washington 6, D. C. San Juan 23, P. R.

another slugger in the OUTPUT lineup



Now — taking its place in the outstanding line of Bucyrus-Erie heavy-duty quarry and mine excavators is the field-proved 4½-yard 110-B — a convertible shovel-dragline which can give you bigger output in rock, ore, or dirt at lower cost than any other machine of like capacity on the market today.

Like the larger 150-B (6-yard) and 190-B (8-yard) machines, the 110-B features Bucyrus-Erie's exclusive shovel front end. The strong, light two-section boom reduces weight and speeds digging cycle, yet provides ample strength for tough digging. Tubular dipper handle, free to rotate in saddle block, permits digging with one corner of dipper without introducing torsional strains. Powerful effective rope crowd reduces swing inertia because crowd machinery is located on revolving frame. And, twin-dual hoist ropes concentrate power where needed to pull dipper through toughest banks.

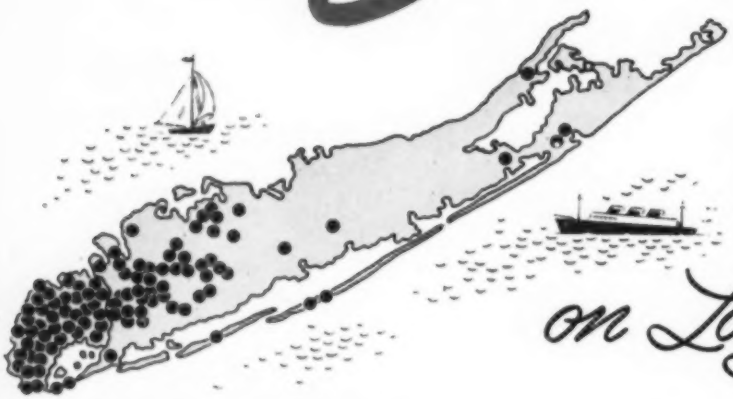
Before you buy any machine in the 4½-yard range, investigate the 110-B. It will give you consistently large ouput at lowest cost per yard. For detailed information, write today for Bulletin 110-B-1. 4L53C

BUCYRUS ERIE

SOUTH MILWAUKEE, WISCONSIN

Now 3 more added to the scores of

ELEVATED TANKS
by
PITTSBURGH •DES MOINES
on Long Island, n.y.



FRANKLIN SQUARE, *Long Island, N.Y.*
300,000 Gallon Double Ellipsoidal Tank.
Diameter 50 ft, head range 39 ft, height to bottom 95 ft.

HEMPSTEAD, *Long Island, N.Y.*
1,250,000 Gallon Radial Cone Tank.
Diameter 74 ft, head range 40 ft, height to bottom 110 ft.

ALBERTSON, *Long Island, N.Y.*
500,000 Gallon Double Ellipsoidal Tank.
Diameter 50 ft, head range 39 ft, height to bottom 126 ft.

Pittsburgh-Des Moines Elevated Steel Tanks serve densely-settled Long Island from the great metropolitan center of Brooklyn, through the busy commuter towns, to remote villages in the eastern rural areas. The dependability and satisfactory performance of these structures recommend them continually to communities desiring improved water service. We will be glad to supply complete details and consult on your requirements, upon request.

PITTSBURGH•DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

PITTSBURGH (25) . . . . . 3470 Neville Island
NEWARK (?) . . . 251 Industrial Office Bldg.
CHICAGO (3), 1274 First National Bank Bldg.
LOS ANGELES (48), ... 6399 Wilshire Blvd.
DES MOINES (8), 971 Tuttle Street
DALLAS (1), 1275 Praetorian Bldg.
SEATTLE . . . . . 578 Lane Street
SANTA CLARA, CAL., 677 Alviso Road

Dozens of Uses • Thousands of Users

Prove Ability, Versatility of the Model D

The thousands of satisfied owners are still finding new uses for the able and versatile Allis-Chalmers Model D Grader. It has proved again and again that it has the power and capacity to do outstanding work on both construction and maintenance.

Usefulness of the Model D is multiplied by several easily mounted attachments: hydraulically controlled rear-end loader, shoulder maintainer that is interchangeable with the loader, scarifier, both V-type and blade snowplows.

MORE POWER, NEW FEATURES, LOW COST

For even greater performance ability, power for the Model D has been boosted to 40 brake hp. Also, leaning front wheels and power circle turn now are available (optional). With these and other big-grader features such as tandem drive, ROLL-AWAY Moldboard, tubular frame and hydraulic blade lift — the Model D's original cost still is but one-third that of a large grader. Operating costs are low, too.

Your Allis-Chalmers dealer will be glad to demonstrate what the versatile, economical Model D can do for you.

ROLL-AWAY is an Allis-Chalmers trademark.

40 Brake hp. • 8,800 lb. (bare)

Four speeds forward to 25.6 mph., reverse to 3.3 mph.

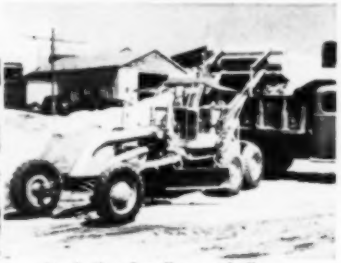
Handles light construction on streets, roadways, etc.

Backfills ditches, packs and levels ground, loads excess dirt to trucks.

Cuts and cleans ditches, slopes banks, grades shoulders.

Loads sand, dirt, snow—any material — to trucks.

Terraces, builds diversion ditches, does miscellaneous grader work.



Stockpiles, handles any bulk materials with 5/8-yd. bucket.

Scarifies, with plenty of down pressure, accurate hydraulic control.

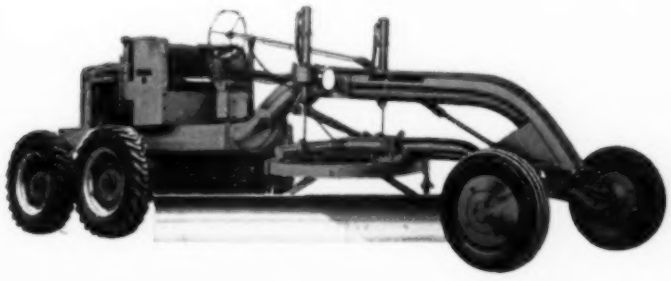
Mixes thoroughly, with rolling action of ROLL-AWAY moldboard.

Finish grades between forms on road and street construction.

Levels for home building, parking lots, play areas, etc.

Rough grades, spreads and cleans up on street or road construction.

Landscapes, grades lawns, slopes, ditches around housing projects.



- **Designed for your jobs**
- **Built to take it**
- **Easy to operate**
- **Easy to service**

ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

Dallas Prefers Concrete Pressure Pipe

In 1915 Dallas installed the first concrete pressure pipe in its water supply system. Since 1945 several additional miles have been built, and at present a new 23,300 ft. line is under construction.

Dallas engineers prefer concrete pressure pipe because it is easy and economical to install—it requires little or no maintenance—and it has a permanent high carrying capacity. Another important reason for its selection is that water pumped through concrete pressure pipe stays clean—thereby minimizing any odor, taste, and color difficulties.

Like Dallas, many other cities, large and small, are specifying concrete pressure pipe for their water systems. If your city is planning additional water lines, or replacements for old lines, be sure to investigate the advantages of concrete pressure pipe.

Water for Generations to come

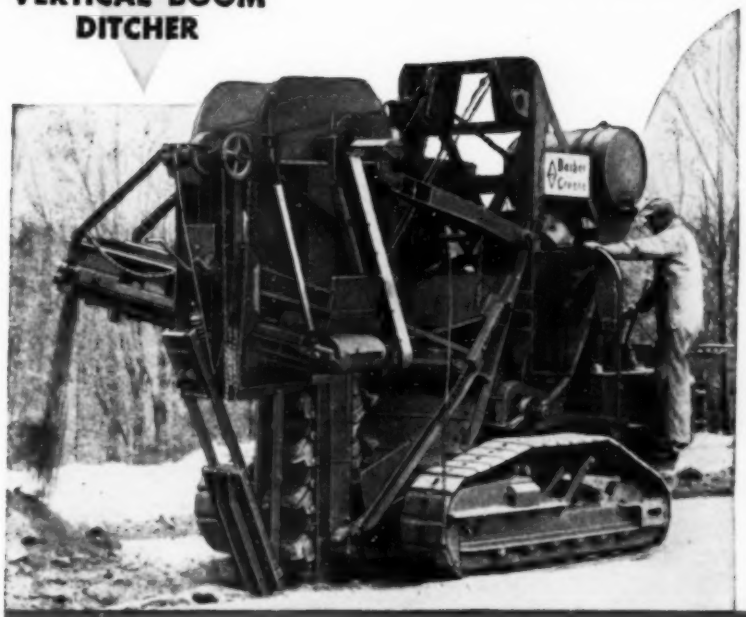
Concrete PRESSURE Pipe

AMERICAN CONCRETE PRESSURE PIPE ASSOCIATION
228 North LaSalle Street
Chicago 1, Illinois

BARBER-GREENE HEAVY DUTY DITCHER

MODEL 44-C VERTICAL BOOM DITCHER

for lowest cost per foot of trench in all weather



SAVE ON JOBS LIKE THESE:

- Highway Widening
- Sewer, Water and Gas Distribution
- Pipe Line Construction
- Airport Drainage
- Uncovering Joints
- Placing Conduit Tile
- Building Foundations
- Farm Tiling
- Grave Digging

DIGS CLEAN... leaves vertical walls . . . square cuts . . . eliminates most expensive handwork.

MILLING ACTION... closely spaced buckets pare small increments as a milling machine cuts metal.

OVERLOAD RELEASE... slips when overload occurs . . . automatically re-sets itself . . . no down time for replacing shear bolts, etc.

Only Barber-Greene offers so many proved ditcher advantages to save time and money on all trenching operations. For instance, the Vertical Boom means a compact, easily maneuvered machine: digs straight down, right up to walks, foundations, underground pipes, etc. . . . digs *all* the ditch . . . no expensive handwork required. The Vertical Boom stays *down* — the harder the digging, the harder the buckets hold it down. Cuts trench to 8'-3" depth, 24" wide.

Self-cleaning "kick-out" buckets operate in a vertical plane . . . produce the famous B-G milling action that cuts through coral, frozen ground, caliche and other formations that completely stop other ditchers.

Another time- and money-saving feature is the exclusive B-G overload release that slips on overload and automatically resets itself until the obstruction is removed or the operator stops machine—and then it re-sets itself for continued operation, protecting machine, hidden mains, cables, etc.

Plan to put the advantages of the B-G Model 44-C to work for you.

Barber-Greene BG

Aurora, Illinois, U. S. A.

High-speed, high-capacity hauler on Lexington Dam—a 225-HP Caterpillar DW20 Tractor with No. 20 Scraper. Travel speed—20 m.p.h. Load—20 cu. yd. heaped, 15 cu. yd. struck.

How Atkinson raced winter to complete Lexington Dam

An important step in the Santa Clara Valley Water Conservation District's program was taken with the completion of the new Lexington Dam. On Los Gatos Creek just north of the old town of Lexington, California, it is designed to eliminate floods and restore the falling water level of this highly productive agricultural valley. Annual wastage from the creek has averaged more than 27,000 acre feet. The dam, with a storage capacity of 25,000 acre feet, makes it possible to salvage nearly all this wastage.

The $1,433,310 Lexington Dam is an earthfill structure, 175 feet high with a top width of 50 feet and a maximum thickness through the base of 1,200 feet. The project really involved two earthmoving projects of about the same size. Before construction could be started on the 2,000,000 cu. yd. dam, it was necessary to relocate 1.77 miles of the Los Gatos-Santa Cruz highway around the dam. This contract, with the State Division of Highways, was about $1,400,000 and involved moving 2,000,000 yards of highway fill, more than half of it in one fill 800 feet long with a maximum depth of 135 feet.

BIG YELLOW FLEET USED

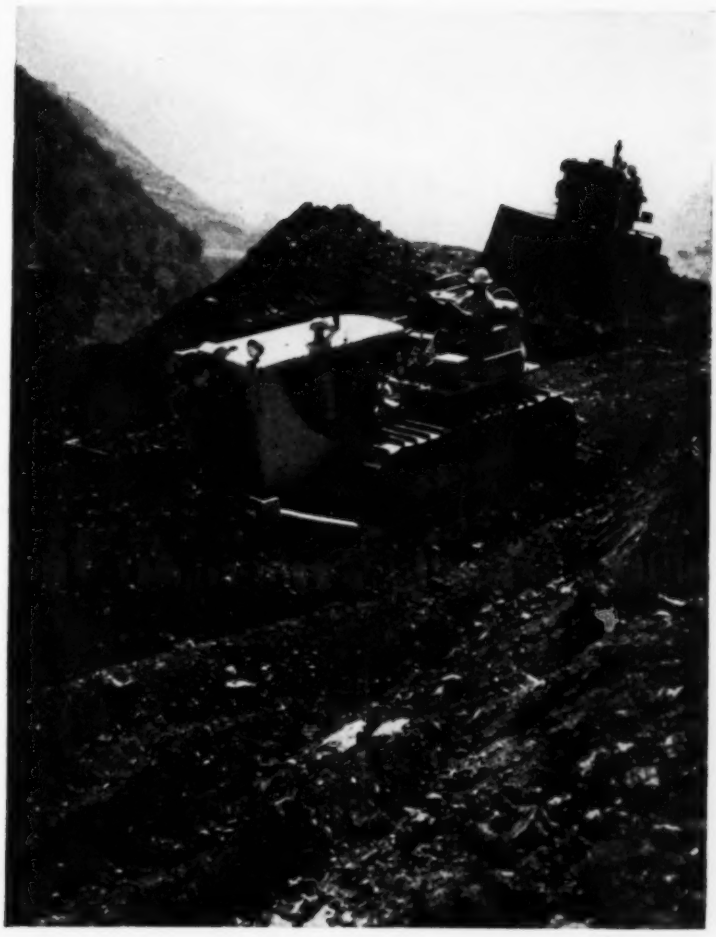
Major earthmover on both 2,000,000-yard projects for the contractor, the Guy F. Atkinson Company, South San Francisco, was Caterpillar* equipment. To meet tight schedules, the company concentrated on a big yellow fleet of tractors, bulldozers, scrapers and engines, first on the roadway, then on the dam. Here speed was vital, with mid-November, 1952, the target date, to beat winter snow and rains.

Atkinson zoned the equipment. Tracks and 'dozers were used on short hauls. Cat* wheel-type DW20 and DW10 Tractors, with scrapers, handled the long hauls. And motor graders did duty on clearance and road maintenance. The company also took every

advantage of standardization. Both moves paid off in big production with a minimum of down time. And the nearby Caterpillar Dealer, with genuine parts and on-the-spot service, helped contribute to the profitable performance.

Time and again, standardization on Caterpillar units has proved a good investment for contractors. There are many reasons. The equipment is the most *standard* of any earthmoving line. Stamina to stay on the job working is built into every part of every machine and engine. Many parts are interchangeable. Maintenance is simplified. Operator familiarity makes for increased efficiency. And it's a major time and trouble saver to be able to call on *one* source for *all* service.

A Caterpillar D13000 Engine powers this Gardner-Denver Compressor, furnishing compressed air for drilling shot holes. Production: 200 feet of 2½-inch holes per 7½-hour day.



Tough as they come – a Caterpillar No. 12 Motor Grader. More than 9 out of 10 Caterpillar Motor Graders ever built are still on the job.

Husky worker–a Caterpillar D8 Tractor with No. 8S Bulldozer does its stuff in rugged going on the dam. The D8 packs 130 HP at the drawbar.

ASK FOR A DEMONSTRATION

For complete information about any unit in the Caterpillar line, see your dealer. Ask him to show you what it can do on your job. Name the date – he'll demonstrate!

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

*Both Cat and Caterpillar are registered trademarks – ®

WHAT DO WE MEAN BY MODERNIZED CAST IRON PIPE?

We mean still *stronger, tougher pipe with sustained carrying capacity* because it is centrifugally cast and centrifugally cement-lined.

All of our member companies have centrifugal casting facilities for producing tougher, stronger *modernized* cast iron pipe. All can supply this pipe with cement lining, centrifugally applied.

This centrifugally-cast pipe is lined, when conditions require, with cement mortar centrifugally applied. Result—a tuberculation-proof pipe with sustained carrying capacity and, therefore, reduced friction loss and pumping costs.

If you want the most efficient and economical pipe ever made for water distribution, your new mains will be laid with centrifugally-cast and centrifugally-lined cast iron pipe with either bell-and-spigot or mechanical joints. Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Ave., Chicago 3.

CAST Q IRON

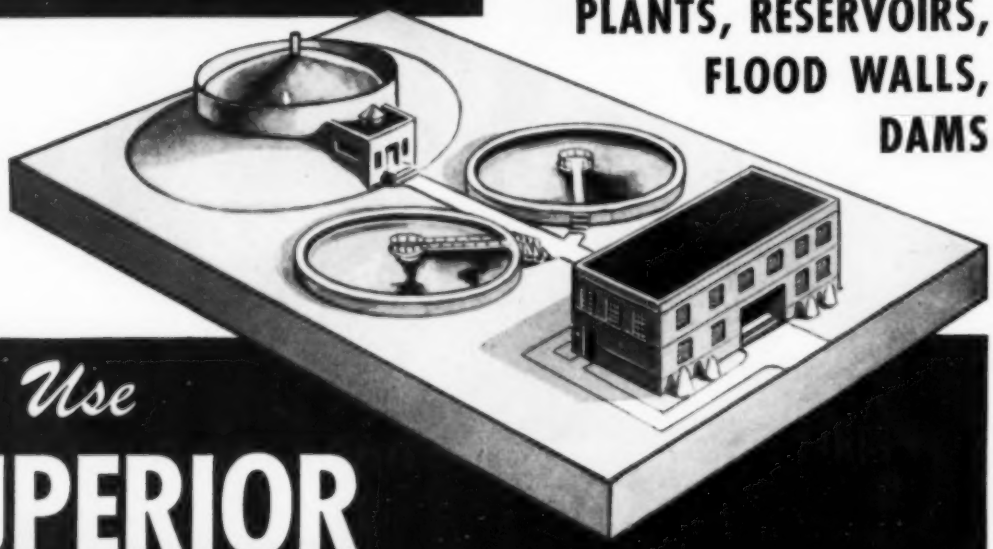
The Q-Check stencilled on pipe is the Registered Service Mark of the Cast Iron Pipe Research Association.

Modernized **cast iron**

This cast iron water main, uncovered for inspection, is in its 104th year of service in Buffalo, N. Y.—one of more than 40 cities with century-old water or gas mains in service.

pipe for Modern Waterworks Operation

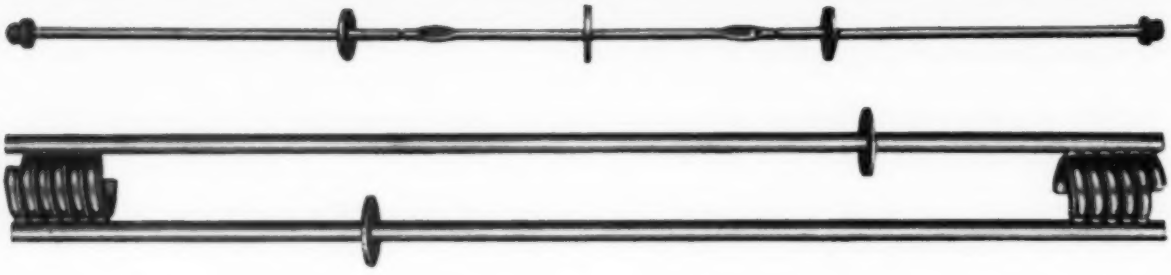
For Watertight Walls in..... **DISPOSAL and FILTRATION PLANTS, RESERVOIRS, FLOOD WALLS, DAMS**



Use

SUPERIOR

Water-Seal COIL OR SNAP TIES



The form tie used for water tight walls must, of course, be leak proof. The type of tie which is truly leak proof is determined by the anticipated height of head, and the resultant pressure.

Superior Snap Ties, and standard and Cone-fast Coil Ties, give satisfactory results for low heads, but for high heads, the use of Superior Water Seal Ties provide a real and justifiable insurance against leakage.

Superior Water Seal Snap Ties, and Coil Ties, both standard and Cone-fast, are provided with a water stop in the form of a securely fixed washer near the middle of the tie as illustrated. This washer effectively breaks the continuity of the rods, preventing seepage along the tie.

On any forming job, use SUPERIOR Concrete Accessories and be assured of the best in material, design and workmanship . . . plus the services of our experienced engineers who are always available to help plan your form work.

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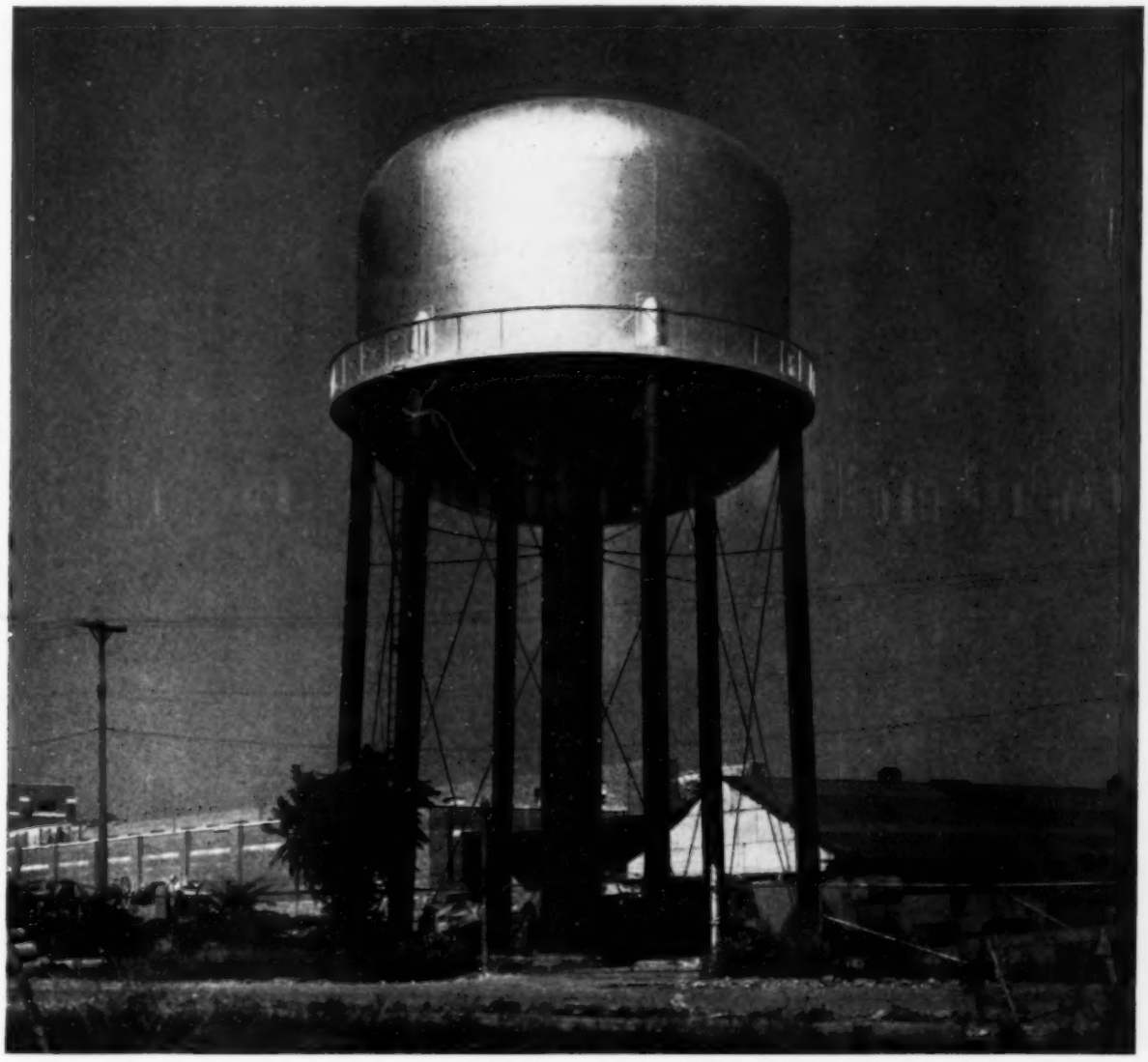

Horton Elevated Wash Water Tank at Dayton

The 200,000-gal. Horton ellipsoidal-bottom elevated tank shown above was installed to provide wash water for filters at the 96,000,000-gallon softening and filtration plant serving the city of Dayton, Ohio. Water from the welded steel Horton tank is available at all times to wash the filters.

Horton ellipsoidal-bottom elevated tanks of the above type have many uses in municipal and private water systems throughout the world. They provide an economical means of providing water for domestic service, fire protection and industrial needs. They are pleasing in appearance, easy to maintain and a most efficient solution to growing water demands.

Horton ellipsoidal-bottom elevated tanks are built in standard capacities from 15,000 to 500,000 gallons. Where larger capacities are needed, Horton elevated tanks are built with radial-cone bottoms in standard capacities from 500,000 to 3,000,000 gallons. For estimates or quotations, please write our nearest office. State capacity, height to bottom and location. There is no obligation on your part.

You are cordially invited to visit our exhibit at the 1953 American Water Works Association Conference in Grand Rapids, Mich., May 10th to 15th.

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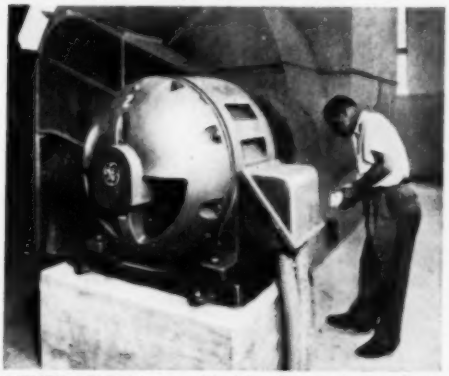
ENGINEERING REPORTS:

OPERATING ECONOMY for the new G-E equipped Norfolk-Portsmouth tunnel is provided by its variable-intensity fluorescent lighting system, Tri-Clad* ventilating-fan motors, centralized control, and reliable power supply.

G-E FLUORESCENT LIGHTING provides safer, more uniform, shadowless illumination. To avoid light-blindness at portals, intensity is increased during bright sunlight periods.



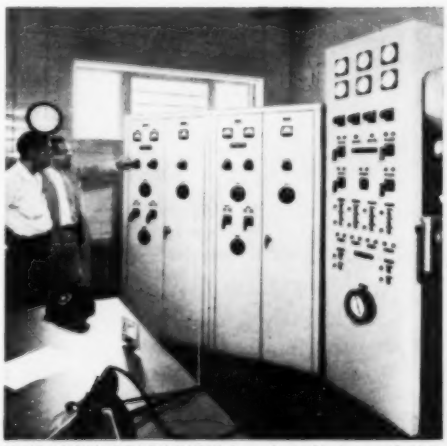
VENTILATION is provided by four exhaust fans, each driven by a G-E 2-speed, 250/40-hp motor. Motors run at high speed only in emergencies.

Continuous lines of light increase safety of new tunnel

G-E electrical system for Norfolk-Portsmouth Tunnel also features one-man control, reliable power supply

An outstanding feature of the 3350-foot tunnel, recently built beneath the Elizabeth River as part of a bridge-tunnel project linking Norfolk and Portsmouth, Va., is the electrical system that helps handle heavy traffic with greater safety and economy. The electrical equipment was designed by General Electric engineers working closely with the Elizabeth River Bridge Tunnel Commission, its consultants, Parsons, Brinckerhoff, Hall & Macdonald, who designed the system, and its contractor, Merritt-Chapman & Scott.

Let G-E engineers help your engineers or consultants on electric equipment for heavy construction projects. Contact your local G-E Apparatus Sales Office early in the planning stage. General Electric Company, Schenectady 5, N. Y. *Reg. trade-mark of General Electric Co. 664-27



ONE-MAN OPERATION is a key feature of this main control panel from which lighting, ventilation, and two G-E unit substations are controlled.

Engineered Electrical Systems for Heavy Construction

GENERAL ELECTRIC

There are several reasons why you can build better culverts with concrete pipe.

Concrete pipe culverts can be designed economically for any combination of drainage requirements and site conditions.

Concrete pipe culverts can be installed easily and quickly. Notice the simplicity of the installation in the above Michigan highway photo.

Concrete pipe culverts have achieved outstanding service records in thousands of highway installations in every state in the Union as well as under the lines of many leading railroads.

Concrete pipe culverts have adequate strength to sustain the heavy overburdens of high fills.

Concrete pipe culverts offer maximum hydraulic capacity because of their smooth interior walls and clean, even joints.

Concrete pipe culverts are moderate in initial cost and need little maintenance. Years of service under state and Federal highways—and railroads—prove their exceptional durability.

Concrete pipe culverts give *low-annual-cost* service—the result of moderate first cost and small upkeep expense over their long useful life.

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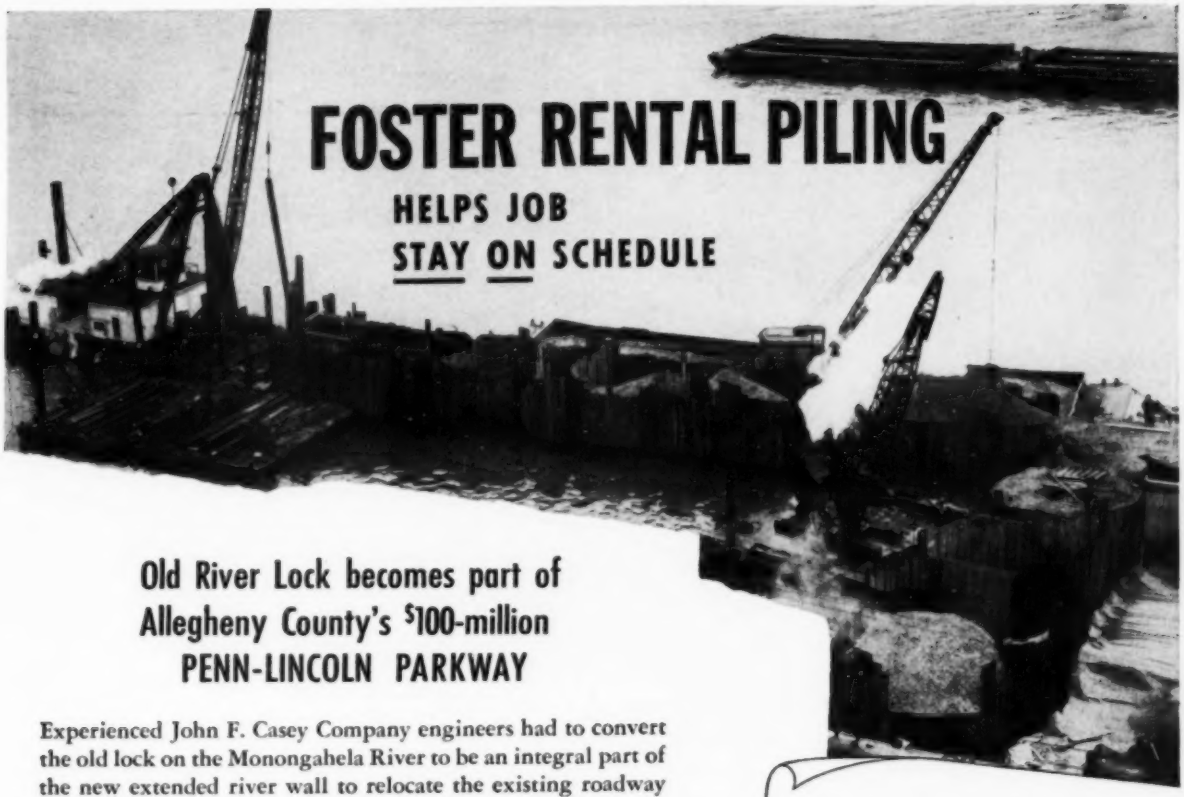

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HELPS JOB STAY ON SCHEDULE

Old River Lock becomes part of Allegheny County's $100-million PENN-LINCOLN PARKWAY

Experienced John F. Casey Company engineers had to convert the old lock on the Monongahela River to be an integral part of the new extended river wall to relocate the existing roadway and accommodate the new Penn-Lincoln Parkway. Casey engineers drove cellular cofferdams averaging 23'9" in diameter to keep water seepage to the minimum on this tremendous engineering project. Their careful planning insured an efficient, uninterrupted work schedule in constructing the river wall, and an important part of the schedule depended on Rental steel-sheet Piling from Foster. Foster delivered ahead of schedule, in the exact sections (MP-112) and in the specified lengths.

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Pittsburgh 30, Pa.

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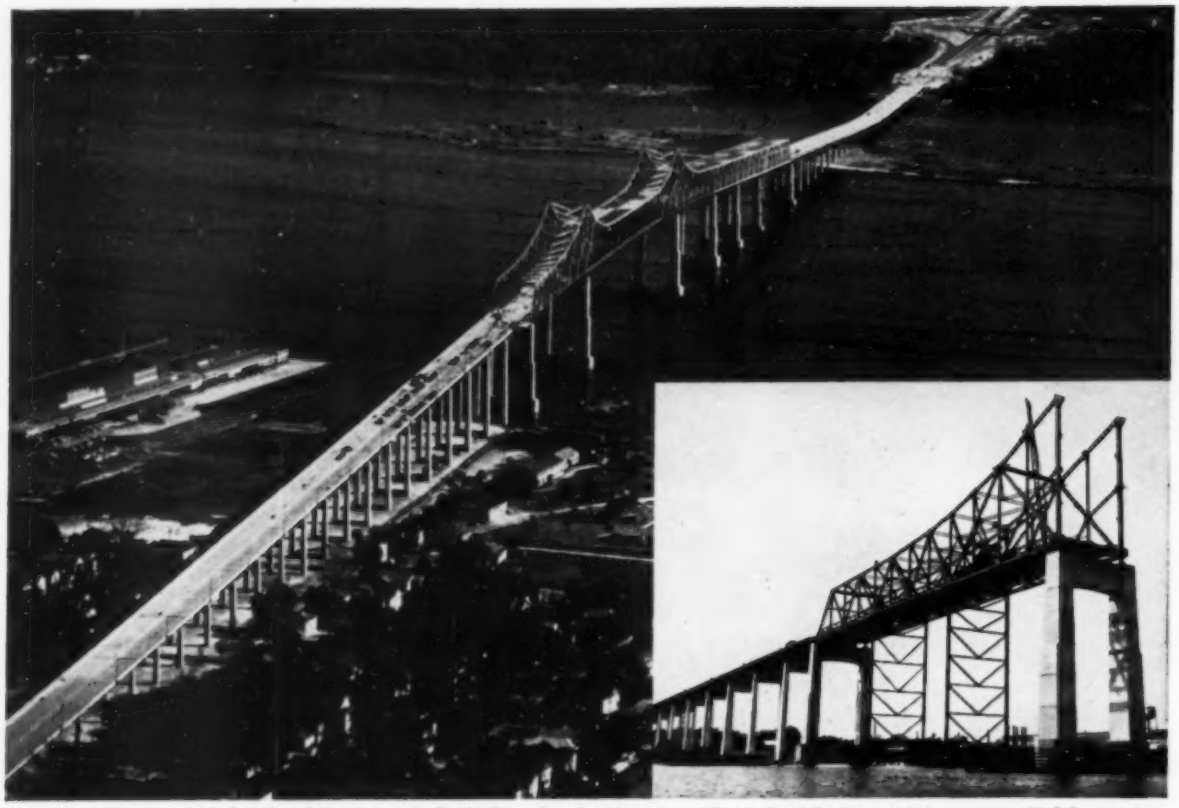
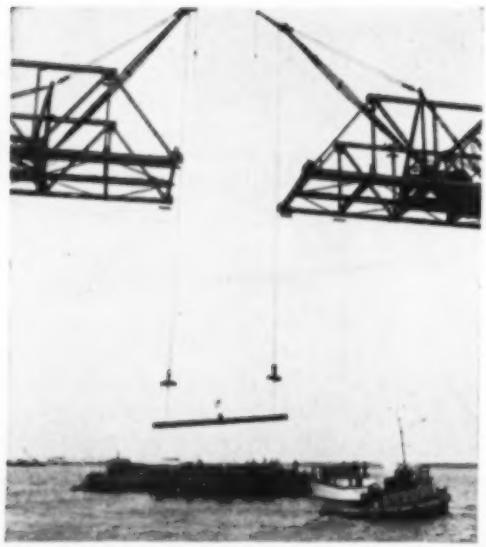


Left: Air view, looking east, of John E. Mathews Bridge, Jacksonville, Florida. Owner: State Road Department of Florida; Sam P. Turnbull, state highway engineer; W. E. Dean, engineer of bridges; Designers and Supervisors of Construction: Parsons, Brinckerhoff, Hall & Macdonald, New York; and Reynolds, Smith and Hills, Jacksonville, Associated Architects and Engineers. Right: Erection, on falsework, of main-span 406-ft anchor arms. Girder spans shown at left of this picture.

New Bridge Is Link In Jacksonville Expressway System



Bottom chord, 67 ft long and weighing 16 tons, being lifted from barge. It joins the cantilevered arms, and is the closing chord in the main span.

This magnificent new high-level bridge at Jacksonville, the John E. Mathews Bridge, is one of the largest of its type ever built in Florida. The 7376-ft structure was named for a justice of the Florida Supreme Court. It crosses the St. John's River, connecting Jacksonville with Arlington, and becomes a major unit of the Jacksonville-Duval County Expressway System.

The main-channel span of the John E. Mathews Bridge is an 810-ft through-cantilever truss, providing a 700-ft clear channel between fenders. The truss has a 150-ft underclearance at low water.

The bridge's approaches are beam spans and simple plate-girder spans, up to 115 ft in length. The 3447-ft east-end approach to the main span includes three truss spans, having a total length of 986 ft. The west-end approach is 2306 ft long. The main cantilever spans, consisting of two 406-ft anchor arms, plus the channel span, have a combined length of 1622 ft.

The bridge's four-lane roadway is divided by a raised concrete mall, 4 ft wide. There is also a 2-ft walk at either side of the roadway. With the exception of the main span, with its steel-grid floor, the roadway is of reinforced concrete.

Construction of the John E. Mathews Bridge was carried on from both banks of the river simultaneously. Steel for the 13,000-ton superstructure was rolled, fabricated and erected by Bethlehem.

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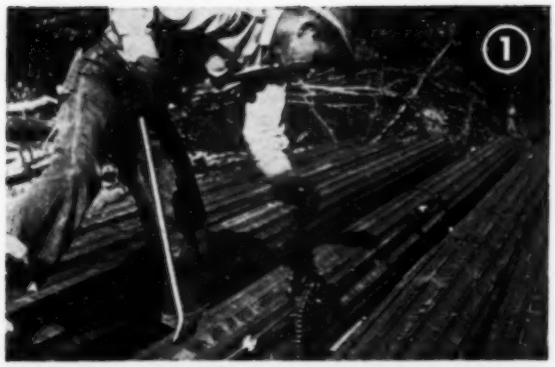

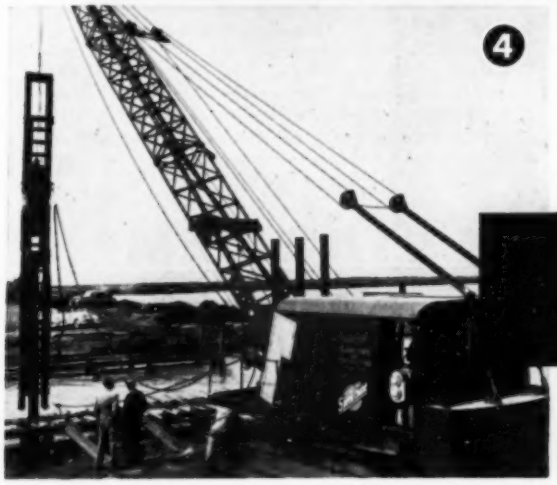

BIG SAVINGS ...4 WAYS with

MONOTUBE tapered steel piles

THE list of Monotube advantages is long. And you are welcome to *all* the facts . . . anytime. Meanwhile, think of the time and money you can save as a result of . . .

1. FIELD ASSEMBLY. Monotubes can be quickly, easily tailored to required length on the job, minimizing cut-off waste and saving time. Photo shows simplicity of nesting a Monotube extension with a "come-along" and two cable chokers.

2. SIMPLIFIED EXTENDIBILITY. When piles cannot be driven in one piece, Monotubes are readily welded and extended to *any* length as driving progresses. You eliminate complicated welding procedure by using a simple "girt" weld under normal driving conditions.

3. EASY CUT-OFF. With lightweight Monotubes, the cut-off operation is fast and easily accomplished. Careful use of cut-off sections as extensions minimizes waste.

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For complete information, for more evidence that you'll be 'way ahead with Monotube piles, write to The Union Metal Manufacturing Co., Canton 5, Ohio.

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● The more popular the truck, the greater the need for good service facilities, supported by a reservoir of parts, such as this huge, new MACK TRUCK Parts Warehouse, near Somerville, N.J.

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Easy-working 'Incor' mixes cut placing and finishing costs. Example: The Ready-Mix Operator on this job was unable to supply 'Incor' for several days, and *D. O. EVANS, Hillside, N.J., General Contractor, says that, on switching back to 'Incor', his costs dropped 35%.*

Above all, 'Incor' helps assure a stronger, longer-lasting floor, by curing *thoroughly* in the short time concrete can be kept wet—and thorough curing is vital to wear-resistance.

With 1-day curing, 'Incor' produces at 1 year 40% higher strengths than even Lone Star Cement concrete—and 'Incor' cured 1 day has less absorption than ordinary portland cement concrete cured 7 days.

For extra years of service—for a veritable bulldog of floors—use 'Incor'*, America's FIRST high early strength portland cement.

*Reg. U. S. Pat. Off.

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CIVIL ENGINEERING

MAY 1953

THE MAGAZINE OF ENGINEERED CONSTRUCTION

• CONTENTS • VOLUME 23 • NUMBER 5

A. E. Cummings, R. B. Peck	27	**Local materials in high Andes prove suitable for rolled-fill dam**
Edgar J. Garbarini	31	**Design saves construction dollars on Contra Costa Power Plant**
Gail P. Edwards	34	**Modifications in aeration and activated sludge process**
J. P. Yates	38	**What happens to construction when defense spending stops**
Howard P. Maxton	40	**Prefabricated steel piers cut construction costs**
M. L. Dickinson	42	**Construction starts on Cherry Valley Dam**
Walter C. Sadler	45	**Legal responsibility of the registered engineer**
Murray A. Wilson	46	**Long trusses, steel cantilevers for Boeing flight hangar**
D. E. Metzler	49	**Hydraulics laboratory equipment shows principles of flow**
Robert D. Schacherl	50	**Simplified method for hydrographic surveys**
Erik J. Sollid	52	**Stresses in frame of Grand Coulee Pumping Plant reduced**
	56	**PROGRAM of ASCE Miami Beach Convention**

• SOCIETY NEWS

	62	**President Huber addresses Mid-South Section**
	63	**Committee on conditions of practice formed at Little Rock**
	63	**M. C. Nichols, M.ASCE, to head Bureau of Reclamation**
	63	**Honorary Members, W. P. Creager and Gano Dunn, die**
	64	**Metropolitan Section selects seven engineering wonders**
Joseph H. Ehlers	65	**From the Nation's Capital**
	66	**Notes from the Local Sections**

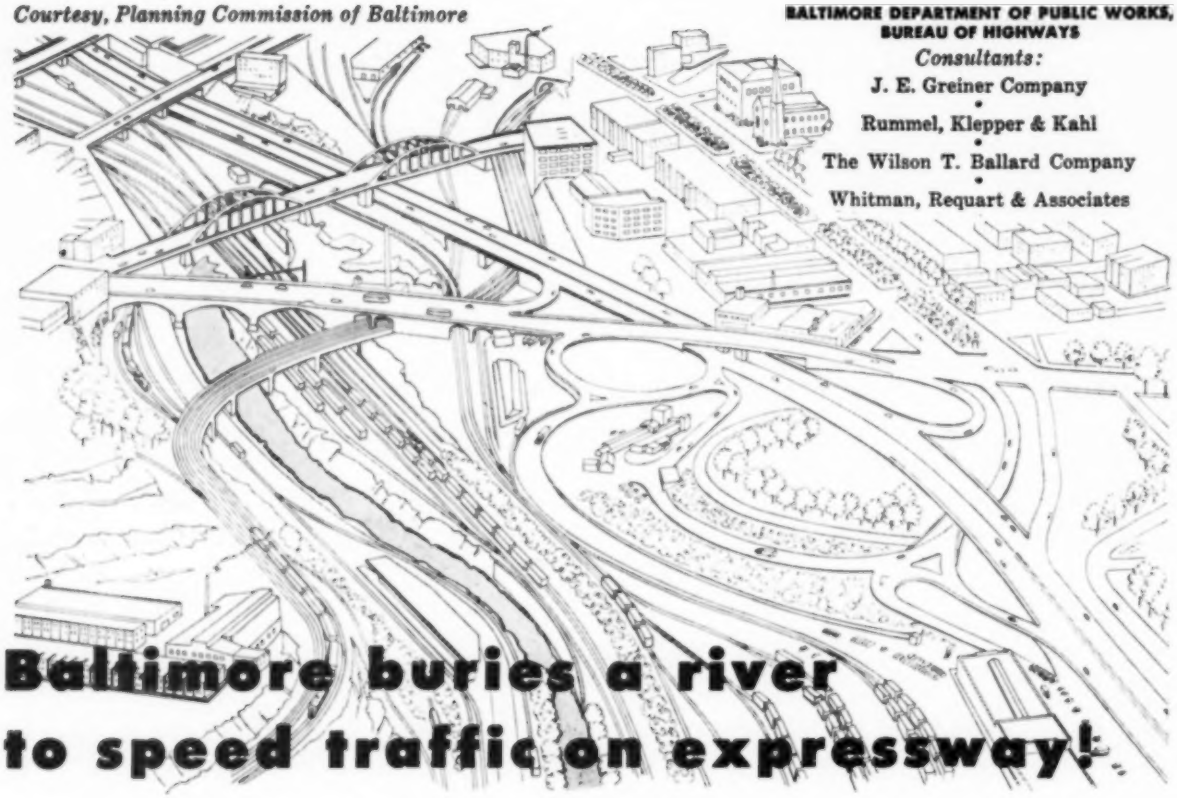
• NEWS BRIEFS

70	**AGC acts on industrial problems at 34th Annual Convention**
70	**All-welded building started for medical center**
71	**New bid received on Thruway Bridge**
71	**Plans for Mackinac Straits Bridge shelved**
73	**Early damage to WASHO test road analyzed**
74	**Construction expenditures at record level for first quarter**

• DEPARTMENTS

44	How Would You Do It?	94	New Publications
50	Field Hints	98	New in Education
52	Engineers' Notebook	102	Men and Jobs Available
52	The Readers Write	107	Non-ASCE Meetings
66	ASCE Conventions Scheduled	108	Applications for Admission
78	N. G. Neare's Column	110	Equipment, Materials and Methods
80	Deceased		
85	News of Engineers	118	Literature Available
90	Recent Books	124	Index to Advertisers
119	**Proceedings Papers Available as Separates**		

Courtesy, Planning Commission of Baltimore



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Whitman, Requart & Associates

Baltimore buries a river to speed traffic on expressway!

Baltimore's new Jones Falls Expressway is designed to facilitate traffic in and through the city. It's one of several long-needed steps which will relieve the type of congestion many cities are facing. The highway must pass through the center of town, adjacent to the Pennsylvania Railroad Station, the U. S. Parcel Post Building, and over the tracks of the Pennsylvania and B & O railroads and other valuable property. To accomplish this objective, Jones Falls is being boxed, and the highway built over it. Though a small stream in dry weather, Jones Falls becomes a rushing torrent during flash floods, and flows between walls as high as 30 feet. The Jones Falls Expressway design plans include a number of new bridges, the rebuilding of others, underpinnings, underpasses, and construction along steeply sloped valley walls.

The borings to bedrock – 215 in all – were made by Giles, which specializes in marine borings, undisturbed soil sampling, large calyx holes in rock, and all engineering test boring work.

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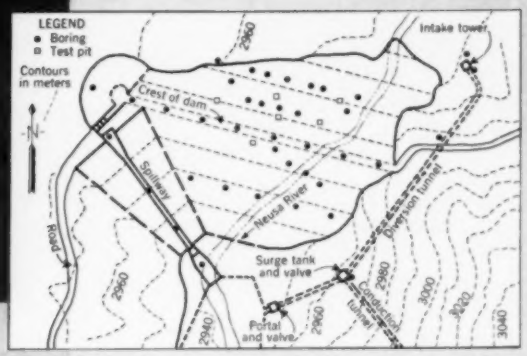


FIG. 1. Rolled-filled dam has maximum height of 149 ft above river bed and crest length of 1,150 ft. Conduction tunnel at lower right will conduct water to projected powerhouse. Both spillway and relief valve at tunnel outlet discharge into river bed well below toe of embankment. Locations of foundation borings and test pits are shown.

Neusa Dam, on Neusa River in mountains about 35 miles north of Bogotá, Colombia, will impound 80,000 acre-ft for water supply, power and irrigation. Dam was completed in January 1952.

A. E. CUMMINGS, M. ASCE

Director of Research
Raymond Concrete Pile Co.
New York, N.Y.

R. B. PECK, M. ASCE

Research Professor of Soil Mechanics
University of Illinois, Urbana, Ill.

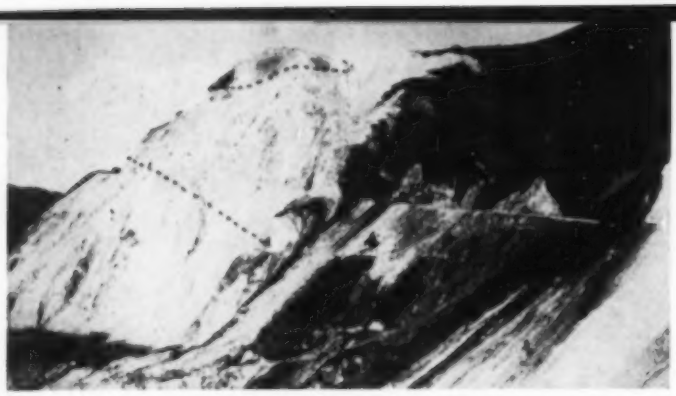
Local materials in high Andes prove suitable for rolled-fill dam

High in the Andes Mountains near Bogotá, Colombia, a rolled-earth dam has recently been completed with its crest almost 10,000 ft above sea level. The dam impounds the headwaters of the Neusa River, a small stream rising in the mountains about 45 miles north of Bogotá and flowing into the Bogotá River about 25 miles from the city at the northerly end of the Valley of Bogotá. It is a multiple-purpose dam, which will assist in the control of floods on the Bogotá River and will provide water for irrigation and water supply and for a future hydroelectric power installation. Preliminary work on the project was started in the fall of 1948 and the dam was completed in January 1952.

Since there were no towns close to the dam site it was necessary to build complete camp facilities including mess halls, sleeping quarters and a small hospital.

A geological study of the site was made by Roberto Sarmiento S. of the National Geological Service of Colombia. The locations of the borings and test pits made at the dam site are shown in Fig. 1. Possible borrow areas were also investigated by borings and test pits. All soil samples were sent to the soil mechanics laboratory of the University of Illinois for testing.

The left abutment, which is comparatively steep (Fig. 1), rests on sandstones and shales with a thin covering of talus material. These rocks, of the late Cretaceous age, are known as the Guadalupe formation. The bedrock under the right abutment, which rises on a more gentle slope, consists primarily of shales or siltstone of the Paleocene or Eocene age, known as the Guaduas formation. Most of the beds are strongly upturned and the stratification is



Fill was taken from mountainside on left bank of Neusa River upstream from dam. Cap of mountain is hard sandstone. Dashed lines indicate location of shales and soft sandstones which were rolled into the embankment. Nature of this Guadalupe formation was such that it was not practicable to separate shales from sandstones.

Various types of heavy equipment were used in construction of Neusa Dam. Sheepsfoot rollers, exerting 400 to 800 psi, rolled material in layers having compacted thickness of about 8 in. At times work had to be stopped because of excessive moisture in fill due to heavy rains. During dry periods some sprinkling was required.

Neusa Dam and Reservoir—General Dimensions

Dam:

Length of crest	1,150 ft
Maximum height above river bed	149 ft
Elevation of crest above sea level	+9,766 ft
Elevation of crest of gates (closed)	+9,756 ft
Elevation of lip of spillway	+9,748 ft
Maximum thickness at base	656 ft
Slope of fill	1 on 3
Volume of fill	1,075,000 cu yd
Excavation and stripping	406,000 cu yd

Reservoir:

Maximum capacity to El. +9,756	80,000 acre-ft
Emergency storage above +9,756	8,850 acre-ft
Maximum emergency elevation of reservoir	+9,766 ft
Area of reservoir	2,400 acres

Discharge Works:

Length of diversion tunnel	1,110 ft
Height of diversion tunnel (horseshoe)	8.2 ft
Discharge capacity of control valves	564 cfs
Height of intake tower above base	136 ft
Normal discharge capacity of spillway	4,650 cfs

Total cost of project was about U. S. $5,000,000

nearly vertical. The two formations are separated by a fault which runs approximately along the present river channel. When faulting occurred, the older and harder formation of the left abutment rose above the younger formation of the right abutment.

The predecessor of the Neusa River carved a valley in the bedrock somewhat larger than the present valley. This probably occurred during the glacial period when the river, fed by melting ice, had a volume much larger than now. Many large landslides occurred and covered the entire valley bottom. The present stream is now eroding this slide material.

Foundation Conditions Explored

Soil samples from the exploratory borings were secured in a split sample spoon, and the investigations included a standard penetration test at each sample location. A series of borings was taken along the axis of the dam, as well as on other lines both upstream and downstream. The undisturbed Guaduas formation was found to be at the bottom of the soil profile with a stratum of stiff clay on top. Above the stiff clay is the slide material in various stages of weathering and various degrees of permeability, with black top soil and organic silt at the surface.

At a few locations on the right abutment sand deposits were found but additional borings and test pits showed that they did not form continuous layers through which water could flow from the reservoir. In addition, grain size determinations indicated that the coefficient of permeability of these sands would be closer to that of an impervious clay than that of a pervious sand or silt. Nevertheless, it was considered desirable to construct a cutoff wall of impervious rolled fill approximately on the axis of the dam and extending from the river channel up the right abutment to the crest of the dam. This cutoff trench is about 13 ft wide at the bottom and 13 ft deep, with side slopes of about 1 on 1. The soil excavated from the trench was spread over the right abutment and rolled into the compacted fill.

The river channel itself was found to contain a practically continuous layer of gravel and boulders from 10 to 16 ft thick. From the axis of the dam to a point about 330 ft upstream from the axis, this material was excavated and replaced by a rolled impervious fill of material selected from the borrow area to provide maximum impermeability. The downstream end of this compacted fill in the river channel was connected to the cutoff wall of compacted fill extending up the right abutment.

Wherever the stripping operations exposed plastic soils in the foundation, samples of these soils were obtained and subjected to unconfined compression tests in the field. If these plastic soils did not have an unconfined compressive strength in tons per square foot equal to $^1/_{30}$ of the height of the overlying embankment in feet, they were removed and replaced with compacted material.

In general, the bearing capacity of the materials was found to be satisfactory. However, at several locations there were beds of saturated clay which could be expected to consolidate under the weight of the embankment. One of these was near the river channel a few yards downstream from the axis of the dam where it would be loaded with almost the maximum depth of fill. In this area a settlement reference point was established and jointed rods were used to extend the bench mark upward through the fill. Continuous settlement records indicated that the rate

of settlement decreased with the increase in load and that settlement practically stopped when the embankment was completed. The total settlement amounted to a little less than a foot.

On the left abutment there was no question about the bearing capacity of the rock. However, exploratory drifts as well as the excavation of the diversion tunnel indicated that the rock contains many joints, some filled with clay. To eliminate the possibility of seepage through this abutment it was sealed by cement grout injections. The grout holes were drilled to depths varying from 100 to 150 ft, and spaced so as to form an approximately square block beneath the upstream slope of the abutment. The cement was injected in the form of a slurry under pressures at the ground surface ranging from 50 to 85 psi. In general, the first holes accepted most of the grout. Subsequent holes took less and in several instances were drilled through seams of grout from earlier injections.

Embankment Design Changed

At the beginning of the investigation of available borrow materials it was believed that the most suitable embankment would consist of an impervious core composed of compacted clay between two shells of compacted Guadalupe sandstone. The weathered clays on the slopes above the right abutment were thought to be suitable for the impervious core. However, when these clays were examined in the laboratory, they were found to consist primarily of the clay mineral halloysite. This is an unusual clay material which possesses very low strength in a saturated condition.

Attention was then directed toward the possibility of making the impervious core out of the thin-bedded soft shales which are part of the Guadalupe formation on the left bank. Laboratory tests of these shales showed that seepage through them would be insignificant.

Other samples of the shale were used for direct shear tests, performed in specially constructed apparatus made necessary by the relatively large size of the shale fragments. These tests showed a high resistance to shear, both in the dry and saturated condition.

Laboratory tests on the sandstone proposed for the shells of the embankment indicated that it could be broken down effectively by rolling with heavy rollers. The resulting aggregate was well graded and would be very dense and stable.

Reinforced concrete spillway on right abutment has three Tainter gates at crest of dam and baffle structure at bottom of concrete chute to break up flow before it enters river channel downstream from dam.

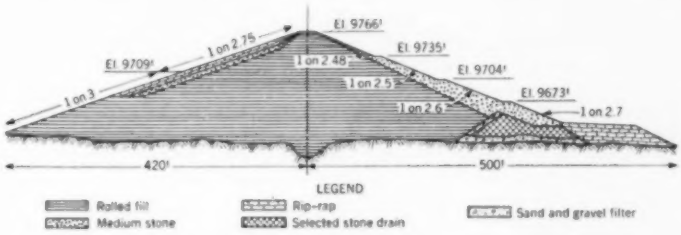


FIG. 2. Maximum cross section of Neusa Dam shows layer of medium stone and riprap facing, each about 6 ft thick, on upstream face. On downstream face, medium stone varies in thickness from about 3 ft at crest to about 10 ft at toe. Three berms are each about 10 ft wide. Transition zone of coarse sand about 3 ft thick was placed below toe drain and wherever this drain is in contact with rolled embankment.

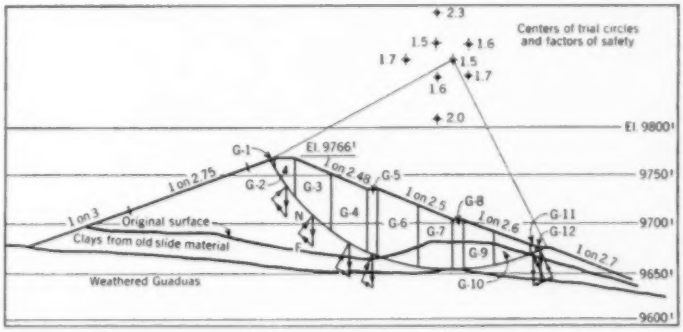


FIG. 3. Final check on stability of embankment was made by assuming eight circular sliding surfaces with different centers to determine most unfavorable condition. Angle of internal friction of fill material was taken at 40 deg and cohesion as zero. For circle shown, which corresponds to most critical condition, factor of safety was computed as 1.5.

Diversion tunnel under left abutment leads to outlet valve below downstream toe, whence discharge flows into former river channel.

After excavation of the borrow material was begun, a test embankment was built with the shale planned for the core. It was evident that this shale could be rolled into an impervious and satisfactory fill, but it was also evident from inspection of the borrow areas that it would not be practicable to separate the shales and sandstones of the Guadalupe formation. It was therefore decided to abandon the shell and core design and to construct instead a homogeneous embankment consisting of a mixture of the two materials.

This decision made it necessary to perform additional laboratory tests on the mixed shale and sandstone. One series of tests was made to determine whether the amount of compactive effort would have a significant influence on the degree of compaction, in other words, whether a large amount of rolling would produce a much denser fill than a relatively small amount. Samples were compacted at approximately optimum moisture content in a standard Proctor mold 4 in. high and 4 in. in diameter. In some of the tests the material was packed loosely into the mold in three layers and each layer gently rodded but not subjected to a measurable degree of compactive effort. In other tests, each of the three layers was subjected to the blows of a hammer weighing 5.5 lb and falling 12 in. The number of blows per layer was varied from 12 to 25, 50 and 100. The standard Proctor test is based on 25 blows. The material dropped loosely into the container and rodded had a relatively low density, but all other materials were relatively compact regardless of whether the number of blows was as small as 12 or as great as 100. Additional compaction as represented by 50 or 100 blows per layer did not materially increase the dry density. It was concluded that no appreciable advantage would be gained in the field by unusual or excessive rolling of the fill; that is, 6 or 8 passes of the sheepsfoot would be almost as effective as 15 or 20 passes.

A second series of tests was made to determine the shearing strengths of the mixed material. These tests were performed in the large shear box previously used for the shale alone. In some tests the material was dumped loosely into the box without any compaction and in others it was compacted to various percentages of the standard Proctor value. The friction angle was found to increase with an increasing percentage of compaction. Although the specifications required 90 percent of standard Proctor compaction, the analysis and design of the embankment were based on a friction angle of 40 deg, which corresponds approximately to 84 percent of standard Proctor compaction.

It was necessary to locate a quarry since heavy rock was needed for riprap on the upstream face, for broken rock on the downstream face, and for the transition zones and the filter in the toe of the dam. Suitable hard sandstone was found in the Guadalupe formation on a mountainside on the left bank of the river a short distance downstream from the dam site. The quarry face was blasted with heavy shots in coyote holes.

Rains Impede Rolling of Fill

Material from the borrow area was hauled in dump trucks and spread on the embankment by road patrols and bulldozers equipped with blades. It was then compacted by sheepsfoot rollers of the type adopted as standard for heavy rollers by the U. S. Bureau of Reclamation. The pressure on the feet varied from 400 to 800 psi and the material was rolled in layers having a thickness of about 8 in. after compaction. At times considerable difficulty was experienced in rolling the fill because of heavy rains, and on several occasions work had to be stopped altogether because of excessive moisture in the fill. During dry periods some sprinkling was required to keep the moisture content up to the optimum.

Approximately 350 field density tests were made during the construction of the embankment to check the degree of compaction. The average of all the tests was approximately 91 percent of the standard Proctor value, and variations from the average were generally small. In a few places, where several tests in one locality indicated less than specified compaction, the material was removed and replaced by material of greater density.

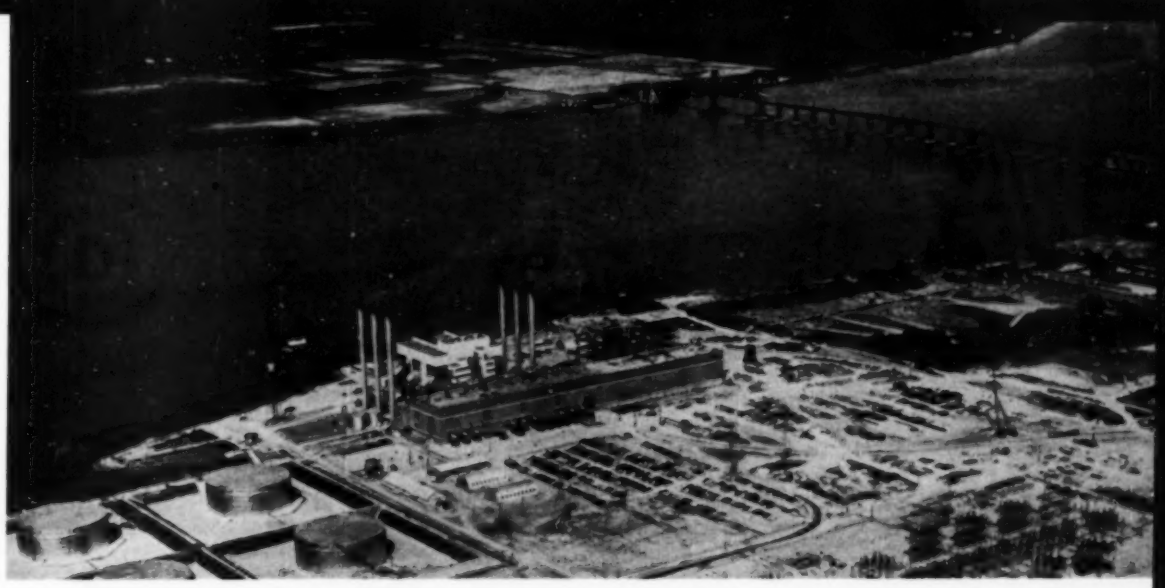
Approximately 100 field permeability tests were made by excavating holes about 4 in. in diameter and 4 ft deep with a hand auger. Each hole was filled with water to within about 6 in. of the ground surface and the water was then allowed to seep out while the drop in water level was measured. The results were plotted as a series of curves showing the drop in water level as a function of elapsed time in hours. These tests were designed to disclose the uniformity of conditions in the field and to give an indication of the permeability of the compacted embankment. They are not subject to precise interpretation in terms of the coefficient of permeability of the embankment material. However, approximate computations showed that even the most unfavorable test results indicated a coefficient of permeability somewhat less than half of that assumed in the original seepage calculations.

The maximum cross section of the dam as built is shown in Fig. 2. The upstream slope is surfaced with stone riprap having a thickness of about 6 ft. Between the riprap and the rolled fill is a transition zone of medium stone also about 6 ft thick. The downstream slope is covered with a blanket of medium stone about 3 ft thick at the crest of the dam increasing to about 10 ft at the downstream toe. This slope is provided with three berms each about 10 ft wide. In the downstream toe of the dam is a free-draining fill of selected material. Below the toe drain and also wherever the toe drain is in contact with the rolled embankment is a transition zone of coarse sand about 3 ft thick. At the toe of the dam in the old river channel, below the spillway discharge, is a blanket of heavy riprap from 10 to 15 ft thick.

As a final check on the stability of the embankment, a circular sliding surface was assumed and eight different circles were investigated to determine the most unfavorable condition. The angle of internal friction of the fill material was taken as 40 deg with zero cohesion. Where the surface of sliding extended into the natural ground below the embankment, the shearing strength was assumed to be due to cohesion only, with no internal friction. The cohesion was taken as one-half the unconfined compressive strength of the soil. Only that circle which corresponds to the critical condition is shown in Fig. 3, and for this surface of sliding the computed factor of safety is 1.5.

The project was constructed for the account of the Republic of Colombia by the Salinas Section of the Banco de la Republica. The Manager of the Bank is Dr. Luis Angel Arango and the Director of the Salinas Section is Ing. Carlos Gomez Martinez. Dr. Carlos Boshell Manrique was Interventor. The construction work was done by Winston Bros. Co. and Compania Constructora Raymond de Colombia, S. A., as a joint venture with Winston Bros. Co. as sponsor. The writers were consulting engineers to the Banco de la Republica.

(This article is based on the paper by Mr. Cummings and Dr. Peck presented before the Soil Mechanics and Foundations Division session presided over by Alberto Hernandez, M. ASCE, at the Inter-American Convention of Civil Engineers in Puerto Rico.)



Contra Costa Power Plant will have 575,000-kw installed capacity when two units now under construction are completed in 1953. Including 230-kv switching station, plant will cost 80 million dollars.

Design saves construction dollars on Contra Costa Power Plant

EDGAR J. GARBARINI, A.M. ASCE, General Superintendent, Bechtel Corporation, San Francisco, Calif.

A sharp eye on construction procedures enabled designers of Pacific Gas and Electric Co.'s new Contra Costa Power Plant to cut construction costs. Examples of the integrated thinking of designers and constructors which saved dollars on this job are design of the cellular substructure of the turbine room to permit use of big equipment and simple construction methods, and design of the intake tubes to make use of steel tube forms which were available.

Contra Costa Power Plant, with a 575,000-kw capacity, on the south bank of the San Joaquin River, 40 miles from San Francisco, Calif., is one of the latest additions to the Pacific Gas & Electric Co. system. The generating station, together with its extensive 230,000-v transmission switching station, will cost 80 million dollars. Construction has been carried out in two stages. The first three units, with 340,000-kw capacity, went into operation in mid 1951. Two additional units, with 235,000-kw capacity, are now under construction and will be operating by mid 1953.

Looking over the work on tour from ASCE San Francisco Convention are, from left to right: the author; J. G. Wright of Earl & Wright, President of ASCE's San Francisco Section; Walter L. Huber of Huber & Knapik, national President of ASCE; and J. R. Kiely, M. ASCE, Vice-President and Power Division Manager, Bechtel Corporation.

Before the grading and excavation work was started, a number of borings were taken on the river-front site. These indicated that the $\frac{1}{2}$-sq mile area consisted of a deep bed of fine sand underlain with gravel. The topography was nearly flat, with some sand dunes near the river.

In leveling and grading the area, scrapers moved 320,000 cu yd of earth. Excavations for all major structures were unwatered by wellpoints, thus securing the economic advantage of working in the dry and enabling most of the structural excavation to be removed with large pan scrapers and fine graded by a motor patrol.

With ground water 8 ft below yard grade, a single stage of wellpoints permitted work to proceed to a depth of 23 ft below yard grade. Deeper work required a second stage of wellpoints. Shallow work below the natural water table, but outside the wellpoint headers, was done while the ground water in the general area was drawn down. Wellpoints were set in a total of 950 locations, but the maximum number operated at a single time was 740.

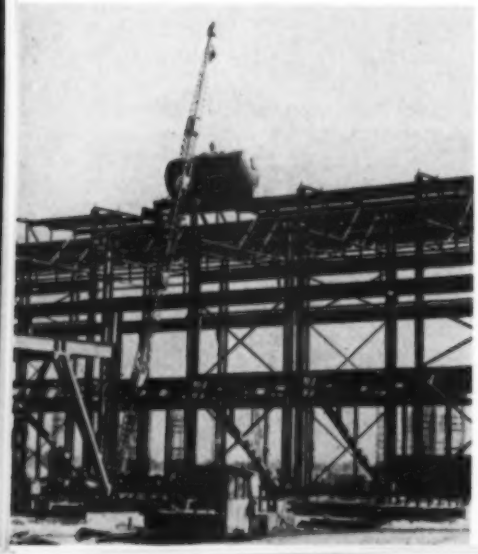
Spread Footings and Piles Used

Although most of the structures were supported on spread footings, three types of piles were used in special cases to meet variable loading and soil conditions. The types used were precast concrete, cast-in-place concrete, and treated and untreated wood. Most of the piles were jetted and driven with standard equipment by the Ben C. Gerwick Co. of San Francisco.

The cellular substructure for the turbine room is a hollow box girder that serves as a spread footing, condenser cooling-water conduit, and raw-water storage tank. Not only was this structure economical because of its multiple uses, but also because its design facilitated construction. Its box shape permitted inexpensive excavation and backfill with heavy equipment; its simple plane surfaces were easy to form; the high proportion of full-length reinforcing bars kept steel costs at a minimum; and the thick wall sections allowed low-cost concrete placement. An appreciable cost saving was realized by using either modular metal or ordinary $^3/_4$-in. board forms for substructure concrete.

Architectural requirements dictated the use of plywood for all superstructure concrete forms, and to keep costs at a minimum, all except floor and roof slab forms were detailed and prefabricated. Access to the under side of the concrete roof slab of the turbine bay was provided economically by a temporary, movable bridge constructed from a pair of standard precut wooden roof trusses and supported on the permanent crane rails.

Careful scheduling permitted 20-ton deaerators to be lifted onto 70-ft-high roof with simple gin poles.



Reinforcing steel was field detailed and fabricated to reduce reinforcing costs, and also to reduce overall costs because of better coordination with other activities.

Concrete was mixed and delivered in transit-mix trucks which were charged from a batching plant at the job site. Aggregates were unloaded directly from railroad cars into the batching plant, and cement was delivered in bulk from the mill by hopper-bottom trucks. All large-volume concrete pours were made with two portable truck-mounted hoisting towers, equipped with counterbalanced swinging chutes, capable of placing concrete anywhere within a 120-deg sector of a circle having an inside radius of 40 ft and an outside radius of 80 ft. For above-grade placing of concrete, the same portable towers, with their chutes removed, were used to hoist the concrete to floor hoppers for placing by buggy. The savings effected by the use of chutes more than offset the extra care necessary in the control of the mixes.

Material Delivered by Rail

A permanent railroad spur from a nearby main line to the power building was built at the start of construction and used to handle 2,700 carloads of material. By temporarily extending the spur part way through the building, and deferring construction of the second floor, it was possible to move the heavy pieces of plant equipment directly from the freight cars to the foundations.

At some time in the past, several barge hulls had been beached and abandoned a short distance offshore from the plant property. By bulldozing sand fill over these hulls they were easily converted into a barge dock, at which all the precast concrete piles and part of the heavy construction equipment, such as pile drivers and large cranes, were unloaded. After the temporary dock was no longer required, the old barge hulls were broken up and removed by a 60-ton crane equipped with a large, job-made, single-tooth rooter instead of a dragline bucket.

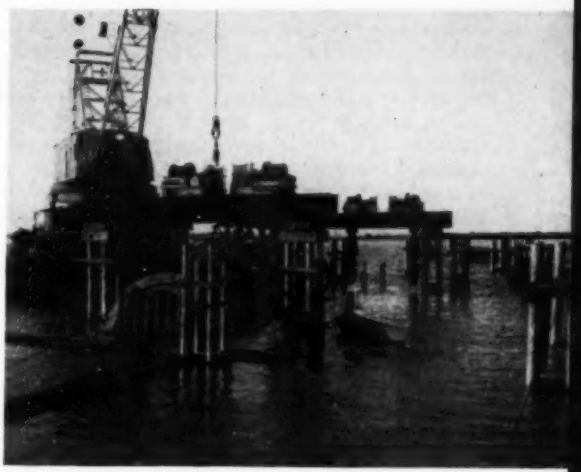
Intake Design Cuts Construction Cost

The condenser cooling-water intake system consists of an offshore headworks located in 38 ft of water, and an onshore screenwell. The two are connected by two parallel, reinforced concrete submarine intake tubes, 400 ft long, 14 in. thick, and 12 ft in inside diameter.

In the early planning stages, an appreciable cost saving was made by adapting the design of these intake tubes to a set of steel forms that had been used on a previous job. The tubes were cast in 100-ft sections on shore, launched, floated to position and lowered onto prepared pile foundations. Wooden piles support the tremie concrete headworks structure and the three support collars, located 100 ft apart along the tubes, at the ends of the tube sections. A few piles in the end support of each tube were very accurately cut off 1 ft higher than the others, so that when the flat-bottomed bell end of the tube sections was sunk, it rested directly on these piles.

Several months before the marine work was started, the eight 100-ft-long bell-and-spigot tube sections, each weighing 480 tons, were precast on level skidways 380 ft long, set perpendicular to the shore and 2 ft above high water in the river. Later, the launching skidways were extended out over the river 35 ft beyond the shoreline, with removable towers at their ends to support the overhead rigging to lower the tubes into the river.

Each tube section, after watertight bulkheads had been fastened on both ends, was slid to the end of the skidway, the lowering tackle was attached and the section was lowered into the river. The lowering tackle was then disconnected and the floating tube section towed 1,500 ft to the intake and positioned over the foundations. Next the lowering tackle, which was placed on the pile supports and straddling the centerline of the intake, was reattached to the tube section, the sea-cocks in the bulkheads opened, and the tube lowered onto the prepared pile foundations. Divers then removed the bulkheads and the tube section was pulled the few inches shoreward required to seat it in final position. The first two sections were placed against the screenwell; then subsequent sections were placed in alternate tubes until all eight were in place. Before the last two tube sections were launched, portions of the concrete forms and reinforcing steel for the headworks structure were attached. Divers completed the gaps in the headworks form, and placed the preassembled forms and reinforcing steel for the collars. After all concrete had been placed by tremie and the tubes unwatered, inspection revealed an average leakage of $2^1/_2$ gpm per joint. The Pacific Bridge Co. of San Francisco performed the marine work on the cooling-water intake. All other work, including the casting of the tubes, was done by the Bechtel Corporation.



Intake tubes were cast in eight 100-ft sections, each weighing 480 tons, and launched from skidways (top left). Removable columns at end of skidway support inboard end of hoisting beam, which was used to lower sections into water (top right). Same tackle used for launching was employed to lower sections into final position (right).

Insignificant Settlement Noted

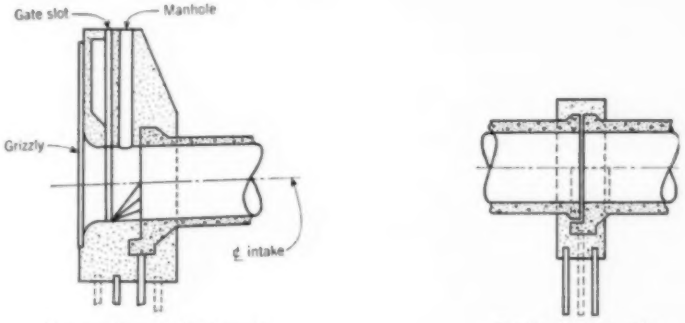
Checking against the bench marks established on all major structures during construction, has shown insignificant settlement. During the first annual shutdown, a part of the cooling water system was unwatered and found to be in excellent condition. Except for planned annual inspection shutdowns, the first three generators have been continuously on the line for almost two years.

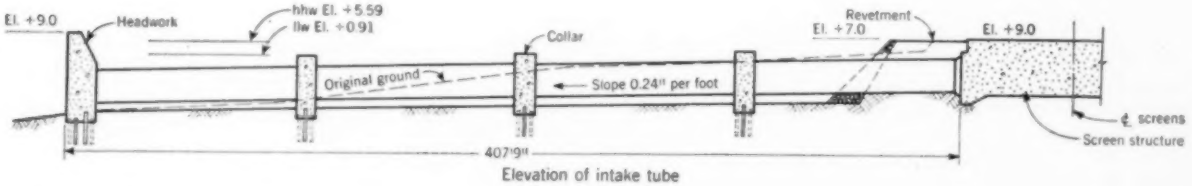
At present the plant burns fuel oil and gas, both supplied by pipeline, but provision has been made for conversion to coal burning at a later date.

The Power Division of Bechtel Corp. designed and constructed Contra Costa Power Station in cooperation with the Engineering Department of the Pacific Gas & Electric Co. The Bechtel Power Division is sponsored by Senior Vice President J. Perry Yates, M. ASCE; is managed by Vice President John R. Kiely, M. ASCE; and has James N. Landis as Chief Engineer. For Pacific Gas & Electric Co., Walter Dreyer, M. ASCE, is Vice President and Chief Engineer; C. C. Welchel is Chief of the Division of Steam Engineering; and H. V. Lutge, M. ASCE, is Civil Engineer.

(This article has been prepared from the paper presented by Mr. Garbarini before the joint session of the Construction and Power Divisions, presided over by A. H. Ayers, a member of the Construction Division's Executive Committee, at the San Francisco Convention of ASCE.)

FIG. 1. Elevation of intake tube shows method of pile support. During pouring of collar, bell end of pipe rested on several piles cut off 1 ft higher than others in cluster. Part of forms for headworks was lowered with intake tube sections and completed by diver. Leakage through tubes was 2½ gpm.





Modifications in aeration and activated sludge process offer flexibility

During the past several years, many modifications of the activated sludge process have been proposed. The purposes of these modifications have been to speed up the process, and to make it more flexible, more efficient and more economical. Also a method has been sought for treating sewage to an intermediate degree, between plain sedimentation and the conventional activated sludge process. Changes in method have been accomplished usually by varying the operation of conventional tanks, but occasionally by using specially designed equipment.

In the design and operation of any activated sludge plant, the question of loading is very important. How much sewage can be treated in a given tank volume? The loading rate may well be expressed as the ratio between the amount of suspended sewage solids added to the aeration system daily and the activated sludge solids under aeration. R. H. Gould, M. ASCE, has suggested the term "sludge age" for the reciprocal of this loading rate. This represents the average number of days the sewage solids remain in the aeration system and is calculated by dividing the weight of suspended solids in the aeration tank by the weight of suspended solids added daily to this tank.

Computations from the data of W. E. Stanley, M. ASCE, on American activated sludge plants indicate that the average sludge age at 23 plants was 4.8 days, with a median of 4.6 days. Individual values varied from about 2 to 7.5 days. Gould believes that the minimum is 3 days. The optimum value probably varies somewhat from plant to plant.

L. R. Setter has developed a modification of the activated sludge process for use where only intermediate treatment is required. In this "modified aeration," or high-rate activated sludge process, a sludge age of 0.35 to 0.50 days has been satisfactory. Other high-rate processes have been developed which use sludge ages up to about one day. Most of the activated sludge processes seem to follow either the conventional activated sludge process with a sludge age of three or more days, or the high-rate process with a sludge age of one day or less. Very few data are available for sludge ages between 1 and 3 days.

For the purposes of this discussion, the various modifications of the activated sludge process have been grouped, as far as possible according to the sludge age, into the conventional complete treatment process or the high-rate process. The conventional activated sludge process is considered to be the simplest form, consisting of aeration of sewage and activated sludge, followed by sedimentation and return of sludge from the settling tank directly to the aerator (Fig. 1).

Modifications of Conventional Activated Sludge Process

Reaeration. Aeration of the sewage and sludge, followed by reaeration of the return sludge in a separate tank to regenerate it, was mentioned as early as 1917 by E. Ardern. Reaeration of sludge was incorporated in the design of the Manchester, England, plant which was put into operation in 1924. F. R. O'Shaughnessy, apparently differentiating between the adsorption and oxidation stages of activated sludge, realized that the two steps could be separated, that all the adsorption, with little or no oxidation, could take place in a mixing tank, and that all or nearly all the oxidation could be done in a separate sludge reaeration tank. In 1924 he obtained a patent on the broad idea of aerating sludge alone and mixing it with sewage before sedimentation (Fig. 2).

This is an important principle and it is interesting to see how many times it has been proposed. The plan of aerating sludge with a little sewage, mixing it with the main flow of sewage, and mechanically flocculating the mixture prior to sedimentation, was patented by S. L. Tolman, M. ASCE, in 1944 and by A. C. Durdin, 3rd, in 1946. Durdin's patent differed from the others mainly in that he proposed aerating and returning to the sewage only the lighter, more active fraction of the sludge. The heavier sludge was to be wasted. No data are available from plants operated according to the Tolman or Durdin patents.

A. H. Ullrich and M. W. Smith have reported the results of pilot-plant studies on this general process, which they have named the "biosorption process." Using raw sewage and with a sludge age of about three days, the process produced effluents containing 13 ppm of B.O.D. and 11 ppm of suspended solids—reductions of about 94 percent. The detention period based on the average sewage flow was 3.3 hours, with about 2 hours of final sedimentation. The average air consumption was 0.93 cu ft per gal of sewage. Purification appeared to be excellent.

The activated sludge process is a time-concentration phenomenon and, within limits, concentration of sludge solids can be substituted for time. By increasing the amount of sludge solids, more adsorbing surface and oxidizing bacteria are supplied, making possible some decrease in the time required for purification. In most standard activated sludge plants, the use of more than about 3,000 ppm of suspended solids in the aerator is not practical. The average concentration of suspended solids in aerators according to Stanley's compilation of data, is about 2,000 ppm. The use of relatively heavy concentrations of solids instead of dilute aeration liquor, permits the use of much smaller tank volumes and would be important in reducing capital costs. Judging from the operating data of the "biosorption process," no appreciable saving in air seems likely.

Step Aeration. The addition of sewage at two or more points along the course of flow of the returned sludge, as proposed by Gould, is called step aeration (Fig. 3). As the points of addition are shifted toward the effluent end of the tank, the length of the sewage contact period decreases and the sludge detention period increases. The purposes of

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step aeration are: (1) to distribute the sewage load effectively throughout the aeration tank; (2) to regenerate the sludge more efficiently by maintaining higher concentrations of solids in the inlet end than in the effluent end; and (3) to circulate a relatively smaller amount of sludge solids through the final settling tanks. The advantage of being able to vary the average concentration of suspended solids in the aeration tanks, and thus the sludge age or loading rate, by shifting the point of application of sewage, is very important in adding flexibility to the operation of the plant.

W. N. Torpey has reported on the operation of the Bowery Bay, New York, plant using the step aeration method. During the period discussed, sewage was added at "B" and "C" passes, one-fourth and one-half way through the aerators, and at "C" and "D" passes, one-half and three-fourths way through the aerators. With a 2.5-hour detention period in the aeration tanks and with a sludge age of 3.5 days, the effluents contained an average of 15 ppm of B.O.D. and 24 ppm of suspended solids, representing reductions of about 90 and 83 percent respectively. Air requirements averaged 0.65 cu ft per gal.

Torpey believed that the results obtained with "C" and "D" pass addition of sewage were superior to those with "B" and "C" pass addition. With "C" and "D" pass addition, a heavier load could be handled while producing a comparable effluent. Addition of sewage in "B" and "C" passes, however, gives more flexibility in operation.

Bioprecipitation Process. A more basic change was suggested by Malcolm Pirnie, Past President ASCE, and studied by D. A. Okun, A.M. ASCE, on a laboratory scale. Sewage was oxygenated with commercial oxygen and then discharged into the bottom of the precipitation unit which contained the suspended biological floc. The sewage flowed upward through the sludge, and the floc was stirred to limit agglomeration and to avoid short-circuiting of sewage through channels in the sludge. Because of the high solubility of oxygen in sewage, no gaseous oxygen was added to the precipitation unit but part of the effluent was added to the sewage, reoxygenated, and recirculated through the precipitation unit.

This bioprecipitation process has some similarity to trickling filters in that the sludge remains relatively stationary in the precipitation unit and the sewage passes through it. During the experiments, the sludge age was estimated to vary from about 1 day to 4 or more days. The theoretical detention period of the sewage in the precipitation unit varied from about 5 hours to 2.75 hours, and the suspended solids in the contact chamber varied from 4,500 to 10,000 ppm.

In general, the efficiency of B.O.D. removal increased with the sludge age, and at an age of 4.3 days (runs 32L, 33L and 34L), the B.O.D. removal averaged 93.6 percent, a reduction from 186 ppm of B.O.D. in the settled sewage to 13.8 ppm in the effluent. Unfortunately, too few tests were made to compare the effect of oxygen and air. However, the use of oxygen seems to produce a greater sludge density than air, and because the oxygen from commercial oxygen is more soluble than that from air, higher sludge solids could be maintained. This would allow shorter contact periods and reduce the size of the precipitation unit.

Logan Process. J. A. Logan has proposed another modification of the activated sludge process which consists of direct recycling of the aeration-tank effluent to the aeration-tank inlet as well as the return of sludge from the final settling tank (Fig. 4). He recommended that the volume of the aeration tank should be about three to four times the volume of the hourly flow of sewage, and that the detention period of the sewage for each pass-through should be about

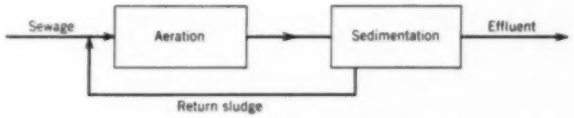


FIG. 1. Conventional activated sludge process, as described in this article, refers to simple aeration of sludge and activated sludge, sedimentation and return of sludge.

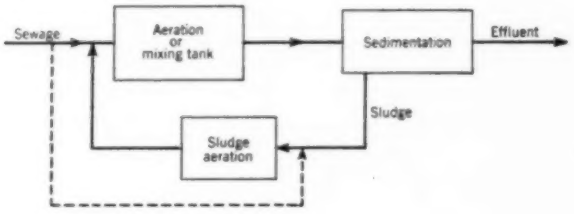


FIG. 2. Reaeration of return sludge was one of first modifications of activated sludge process. Here all adsorption takes place in mixing tank and nearly all oxidation in sludge reaeration tank.

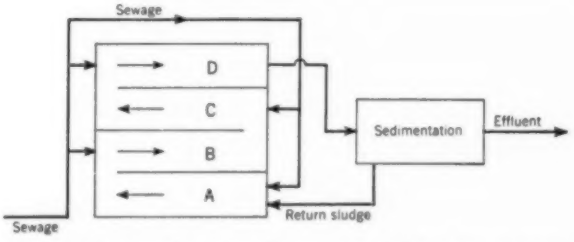


FIG. 3. Step aeration, whereby sewage is added at two or more points, adds greatly to flexibility of operation.

an hour. The total detention period would be about three hours. The purpose of returning the large volume of aeration-tank effluent is to maintain the sludge in a more active condition and thereby to operate in a more efficient manner. No operating data are available.

Guggenheim Biochemical Process. The Guggenheim biochemical process, which consists of the use of ferric salts with the activated sludge process, was tried on a large scale in Chicago and New York. With a moderately strong domestic sewage, the results were satisfactory but the process did not seem to have any advantage over the conventional method. The Guggenheim process, or a modification of it, has been used in New Britain, Conn., since 1937; there high concentrations of metal and other industrial wastes would make the conventional activated sludge process difficult to control.

High-Rate Activated Sludge Processes

High loadings of B.O.D. and suspended solids can be handled efficiently by the high-rate activated sludge process where a highly purified effluent is not required. As proposed by Setter, the process consists of the aeration of low concentrations of aeration-tank solids for relatively short periods with a sludge age of about 0.5 days. However, as in the case of the conventional process, the sludge age can be maintained by using high concentrations of aeration solids and reducing the aeration period accordingly.

Modified Sewage Aeration. The Jamaica, N.Y., plant has been operating as a high-rate activated sludge plant, according to Setter's plan of "modified sewage aeration," since 1943. With a 2-hour aeration period, a sludge age of 0.35 to 0.50 days, and a concentration of suspended solids in the aerator of about 650 ppm, the average removal of B.O.D. and suspended solids was about 76 and 84 percent respectively in 1947–1948. The effluents averaged 30 ppm of suspended solids and 41 ppm of B.O.D. The aeration tank received screened raw sewage, and the air required was 0.39 cu ft per gal of sewage. The excess sludge from the high-rate process was generally much more concentrated than that from the conventional plants and averaged 6.4 percent solids, of which 74.1 percent were volatile.

Zigerli Process. The Zigerli or "Z" process, which was proposed about 15 years ago, depends essentially on the addition of asbestos fiber to the aeration tanks. Fundamentally, the process would apply to either the conventional activated sludge method or to its high-rate modification, but the most comprehensive tests have been made with the high-rate process in Zurich. F. W. Mohlman reported that after an initial dose of 10 to 40 ppm of asbestos, only 1 ppm must be added to the sewage to make up the losses occurring when excess sludge is wasted. Although asbestos is reported to increase the efficiency of the sludge process, no recent data are available to show the results of operation or for comparison with the corresponding process without asbestos. No satisfactory explanation has been offered to account for its reported advantages.

Activated Slurry Process. The activated slurry process depends upon the use of special equipment called the "Aero-Accelator," for the treatment of sewage. This is a single-round unit consisting of a central aeration section which occupies about two-thirds to three-fourths of the total volume of the tank and the remaining outer section for sedimentation. Screened raw sewage and air enter at the bottom center of the unit, where they are intimately mixed with the returned sludge. The mixed liquor rises slowly and flows over a weir into the outer section or return-flow zone. In this section the sludge settles and most of it returns to the central section. The remainder is concentrated and wasted as excess sludge. The effluent is discharged over a peripheral weir at the surface.

Brief pilot-plant studies at Elmhurst, Ill., reported by F. A. Eidsness, A.M.ASCE, showed that with a sludge age of 0.35 days and 512 ppm of suspended solids in the aerator, effluents containing 26 ppm of suspended solids and 24 ppm of B.O.D. were obtained, corresponding to removals of 79.5 and 82 percent respectively. Under these conditions, the sludge index indicated instability of the process.

With a sludge age of about 1.2 days and 3,750 ppm of suspended solids in the aerator, the sludge index (Mohlman) was 136 and the effluent contained 12 ppm of suspended solids and 15 ppm of B.O.D., removals of 93

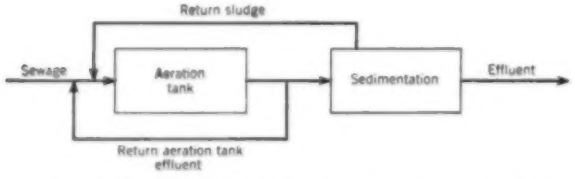


FIG. 4. Logan process modifies activated sludge process by directly recycling aeration-tank effluent and return sludge from final settling tank. Purpose of method is to maintain sludge in more active condition.

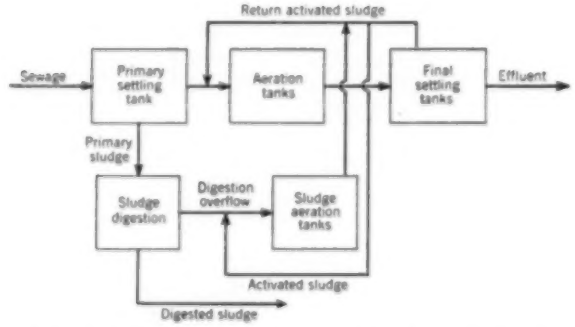


FIG. 5. Kraus interchange process overcame bulking at Peoria, Ill., plant by aerating digester decant with part of return sludge and adding this, with remainder of return sludge, to sewage in aeration tank.

and 89 percent. In each case about 0.35 cu ft of air per gal of sewage was required. The operating data reported for these studies covered only a short period of time. More information is needed to properly judge the value of the method and apparatus.

These high-rate methods of treatment save in capital and operating costs because of the smaller tanks required, the smaller amount of air needed, and the heavier concentration of excess sludge. New plants at Los Angeles, Philadelphia, and New York have been designed for and are using high-rate activated sludge processes.

Two-Stage Processes

Two-stage biological sewage treatment processes have been in use many years. Combinations of aeration (with or without sludge return) and trickling filters were used first at Birmingham, England, more than 25 years ago, and a short time later at Decatur, Ill., as a means of relieving overloaded trickling filters.

In 1945, J. D. Walker, A.M. ASCE, received a patent on a combination which included trickling filters as a first stage, followed by activated sludge treatment. One advantage claimed for this arrangement was that the trickling filter, being less subject to upset by shock loads, could remove about 50 percent of the organic load before treatment by activated sludge. The activated sludge as a second-stage process would produce a superior effluent. The trickling filter and the activated sludge plant together would be smaller than if either were used alone.

In 1930 F. W. Mohlman and C. E. Wheeler, A.M. ASCE, reported on the pilot plant studies of two-stage activated sludge in Chicago. The equipment consisted of two aeration tanks, each with a settling tank. During the four best months of operation, the concentration of suspended solids in the aerators averaged about 3,400 ppm. The total aeration period was about two hours; the air ratio was 0.5 cu ft per gal of sewage; and the sludge age was estimated at about 3 days. Purification was satisfactory, with an average of 7.5 ppm of B.O.D. and 14 ppm of suspended solids in the effluent—removals of 90 and 91.8 percent respectively. They found that the two-stage process was "very sensitive biologically and required careful control."

J. D. Walker has also patented a two-stage activated sludge process in which part of the final effluent is returned to the raw sewage to dilute shock loads and to prevent septic conditions in the primary settling tank. The effluent from either stage may be returned to the sewage.

A two-stage activated sludge process, with reaeration of sludge in each stage, has been developed by Hood and Eckenfelder. They plan to use controls for the oxidation-reduction potential in each aeration and reaeration tank.

Miscellaneous Aeration Processes

Returned-Sludge Process. In Denver, C. P. Gunson is using an interesting aeration process on primary sludge. The plant was originally designed for pre-aeration of sewage followed by flocculation and sedimentation. Gunson eliminated the flocculators and added a tank for aeration of the sludge, which he returns to the raw sewage. The sludge, containing 4 percent solids, is aerated for about an hour, and the overall removals are about 50 percent for B.O.D. and 78 percent for suspended solids. Gunson believes that the returned sludge process must be started in warm weather and that three to four weeks of operation is necessary before satisfactory results are obtained. The high temperature and the time required for starting indicate a biological reaction.

Mr. Gunson has also experimented with a two-stage process which has yielded removal of B.O.D. up to 75 percent.

It is interesting to note that the flow sheet of the Gunson process is very similar to that of the original O'Shaughnessy patent of 1924. Undoubtedly the predominating microorganisms are different, and the removals of B.O.D. less, than with activated sludge.

Kraus Interchange Process. At Peoria, Ill., the activated sludge was in a state of continuous bulking for considerable periods of time because of the high soluble organic content of the industrial wastes received with the sewage. L. S. Kraus corrected this condition of sludge bulking and at the same time disposed of his digester supernatant liquor by aerating digester decant with part of the return sludge and adding this mixture, with the remainder of the returned sludge, to the sewage in the aeration tank. The aerated digester decant and return sludge became an activated sludge with an excellent sludge index (Fig. 5).

Although the process could be used continuously or on an intermittent basis, the best method of operation at Peoria called for the addition of digested sludge or digester decant on alternate days and interchange of the sludges on the days no digested sludge was added. The use of the normal activated sludge on one day and the aerated activated-digested sludge on alternate days reduced the likelihood of losing the activated sludge because of the arrival of destructive loads of industrial wastes. Equal parts of digested-sludge suspended solids and sewage solids should be used entering the aerator.

During four-month test periods, the sludge index (Mohlman) averaged 252 for the conventional activated sludge process and only 118 during the use of the interchange process. According to Kraus, the process affords a means of control of the sludge index; it reduces the effect of shock loads and increases the load capacity of an activated sludge plant without requiring additional air.

Modified Activated Sludge Processes Appear Advantageous

Among the many modifications of the activated sludge process, that proposed most frequently is the aeration of return sludge solids before mixing with the sewage. This method seems to offer savings in capital costs and perhaps in operating expense. Operating results are scarce.

Multiple addition of sewage along the course of flow of the returned sludge, as in step aeration, makes for very flexible operation because it provides for nearly any degree of sludge reaeration and permits a wide range in sludge age or loading rates. Few operating data are available.

Within the past few years, several high-rate activated sludge procedures have been suggested. Relatively short aeration periods with low sludge solids have been used at Jamaica, New York, since 1943, and removal of B.O.D. averaging 80 to 85 percent has been obtained. Where a high degree of treatment is not required, high-rate processes offer savings in first cost and in operation.

In general, several modifications of the activated sludge process seem to be more economical and to provide better efficiency than the conventional method, but not enough data are available to judge the processes on their performance, and almost no comparisons have been made based on standard operation.

(This article has been prepared from the paper presented by Prof. Edwards before a joint session of the Engineering Section of the American Public Health Association and the ASCE Sanitary Engineering Division, presided over by B. A. Poole, John C. Bumstead, and Earnest Boyce, at the Centennial of Engineering Convention in Chicago.)

What happens to construction when defense spending stops

J. P. YATES, M. ASCE, Senior Vice President, Bechtel Corporation, San Francisco, Calif.

From panel discussion, "Effect on Construction Industry in Event of Reduction in Defense Spending," before Construction Division with L. V. Combs as moderator, at San Francisco Convention.

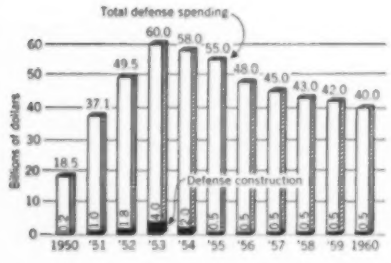


FIG. 1. Defense construction spending is shown to be small proportion of total United States defense spending in decade 1950–1960.

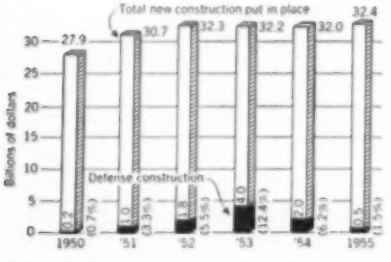


FIG. 2. Defense construction is shown to be small proportion of total new construction put in place in United States in 1950–1955.

Any discussion of the question as to what will happen in the construction field when defense spending stops, must necessarily be general and speculative. However there are many signposts along the way to guide our predictions. First, it seems evident that, under the most favorable world conditions, our country must maintain a relatively high level of defense spending even after the peak is reached this year. Next, it is not at all certain that construction as a whole will slow down appreciably, let alone stop. It may reach even higher levels before 1960.

To throw light on this question it might be well to consider the relationship between total defense spending and the construction portion of this spending for the period 1950–1960 (Fig. 1). In 1950 the total defense spending was less than $20 billion. Based on Department of Commerce figures and on other national defense agency reports, and assuming a continuation of the present world political and economic situations, defense spending is expected to peak in the current year of 1953 at about $60 billion and then to decrease and level off at between $40 and $50 billion for the last 5 years of the decade. As for defense construction spending, it was only a fraction of a billion in 1950 and has increased to a peak of about $4 billion this year. It should drop to $2 billion next year, and then level off at half a billion for the remainder of the 10-year period.

Continuation of substantial defense expenditures will have a sustaining effect on our national economy in contrast to the disruption that might be expected from an abrupt stop. But defense *construction* spending is a relatively small part of the total security spending so that, if construction spending should essentially stop, it would not have a marked effect on the total economy.

Next let us consider the relationship between total construction expenditures and the defense part of these construction expenditures. (See Fig. 2.) In 1950 total construction spending amounted to $27.9 billion, of which only a quarter of a billion, or less than 0.7 percent, was for defense. Construction volume for 1953 is estimated at $32.2 billion of which $4 billion, or 12.4 percent, is for defense. Forecasts for 1954 remain at a total of $32 billion with only $2 billion, or about 6 percent, for defense. Then comes the all-important year of 1955, when according to the present outlook on world conditions, defense construction spending will virtually end. Forecasters again predict a construction volume of $32 billion (at level dollars), and 1.5 percent of this, or about half a billion, for defense construction.

To offset the drop in defense construction and to maintain this estimated volume for 1955, non-defense construction must gain nearly $2 billion over the preceding year. The question therefore is: Assuming the

continuation of a reasonable economy and the present world political situation, will non-defense construction requirements be sufficient to offset the $2 billion, or 6 percent, loss of construction volume from the drop in defense construction in 1955?

Two Important Long-Range Trends

There are good reasons to expect that this total volume can be maintained and possibly even increased. From the long-range aspect, two important factors favor a high level of construction activity in the future. The first is the tremendous increase in population now being experienced in the United States. The forecasts of the Bureau of the Census predict a population increase between 1950 and 1960 of about 22 million, or 15 percent. The effect of this rapid growth on construction activity is self evident. Schools, homes, community and commercial buildings, utilities and highways all must expand. Even more important will be additional production facilities to supply food and consumer goods. These growth figures are averages for the nation as a whole. The West must provide for an additional impact due to migration since its increase in population is expected to continue at a rate nearly 50 percent above the national average.

The second important long-range factor has to do with consumption of our basic natural resources. The increase in demand is expected to be accompanied by a steady increase in the real cost of production of raw materials. It is not necessary to use much imagination to appreciate the enormous influence on heavy industrial construction resulting from the ensuing changes in processes and the development of substitute materials. Thus the continued increase in population and the increased difficulties in the production of sufficient raw materials will both be important factors in sustaining a high volume of construction.

Specific Stimulating Factors

Now, turning to more specific factors that may create construction activity to replace the loss of defense construction in 1955, let's look at federal expenditures for non-defense items, which in 1952 were $3\frac{1}{2}$ times as great as in 1946. The Department of Commerce says:

"On the basis of past experience, construction is the most dynamic item in federal purchases other than those for national security. The area is one of significant potential growth in the absence of specific policies restricting it, and a volume of construction much higher than that registered in the past few years could be achieved if that were the object of our national policies."

There is no indication from the new administration of a curtailment in federal construction. Facts would seem to indicate that:

1. Government aid to private home building will continue and will become even more important though there will be less public-owned housing.

2. Federal aid to highways will certainly be increased and will be an important factor.

3. Federal grants for schools and hospitals are expected to increase.

Public Construction Demand High

Turning to state and local government construction, we find an almost desperate need for construction to bring facilities and services up to community requirements. Since 1945, non-federal public construction has increased from $1 billion annually to over $6 billion in 1952. In spite of this increase, we are not keeping up with requirements. When defense restrictions on critical materials and manpower are released, so that projects can be planned efficiently and with confidence, the retarded programs for schools, streets, highways, institutions, and other public works may well accelerate to the point where they alone could offset much of the drop in defense construction.

Construction of arterial and local highways, with their structures and bridges, is a major phase of public works worthy of special note. Many roads are yet unsurfaced; many highways are overcrowded and dangerous. The congestion in our cities is appalling. In the San Francisco Bay area alone, one new bridge is just being started and two more major crossings must be started soon. This rising tide of demand for highway improvement unquestionably will add a very substantial construction volume as soon as the defense pressure decreases.

The outlook for non-governmental or private-enterprise construction is also bright. In this field perhaps more than any other the right atmosphere and a feeling of confidence in the future are prerequisites to expansion. Today there is an optimistic attitude and many major manufacturers, such as the Ford Motor Co., have already announced large construction programs. Every day we hear of new programs. The electric and gas utility companies will continue to be strong investors in new facilities. Modernization and replacement programs are expected to increase substantially not only because of physical exhaustion of equipment, but also to reduce labor costs and to meet obsolescence through technological developments.

In 1951 and 1952, farmers spent $2 billion annually in construction for homes and service buildings. This is expected to slow down in 1953–1954, not because the demand is satisfied, but because farmers' incomes are dropping. If farm conditions improve, farm construction will again increase.

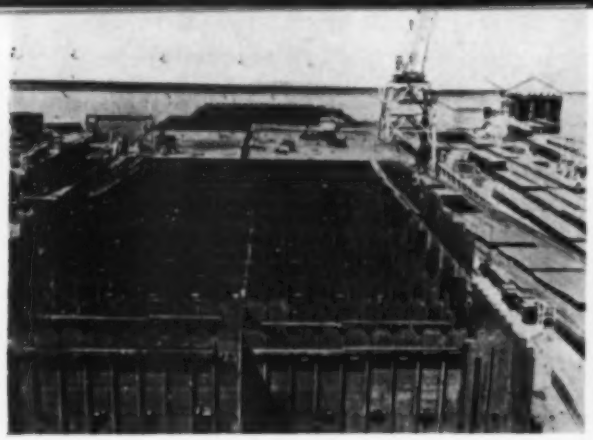
In the field of private residential construction, $11 billion was spent in 1952. In 1953–1954 the rate is expected to go down somewhat, but predictions are that by 1955 there will again be a high demand, consistent with an increasing population and a high-level economy.

There is one more field of construction activity that is becoming of increasing importance, and this is the foreign field. Every day we hear of plans for new world projects, both private and governmental. The position of the United States is becoming world dominant, and the foreign market for construction is enormous. If the world political tension decreases so that defense spending is not needed, the drop in such spending could easily be more than offset by the increase in foreign spending—not foreign aid, but real investment by private capital.

Future Outlook Bright

To summarize, looking at all the facts and future needs, I believe that we are underestimating the future and that we had better be ready to handle an increase in construction activity. Our country is in a unique domestic and world position right now, and if we are to grasp our opportunities, there must be broad and intelligent planning.

We as engineers have an increasing opportunity and responsibility to maintain our dominant world position and we must not underestimate these responsibilities. We must create confidence and support the desire for private investment by being ingenious and efficient in doing the best possible work for the lowest possible cost. We must each as a citizen be active and constructive in our participation in community, civic, and national affairs. We can and must make a real contribution in establishing in the eyes of our own country and in the eyes of the world that our system of free and individual enterprise is the right one.



Interior of prefabricated pier section, designed and erected by De-Long Engineering & Construction Co., is compartmented for safety during towing. Diaphragms also provide rigidity. Completed 82 × 377-ft pier section, at right, is ready to be launched. Note that

DeLong Airjacks have not yet been fastened to deck, but holes through which steel caissons will be driven at site have been incorporated. Sections were fabricated in Texas shipyards and towed 3,000 miles to pier site in Venezuela.

HOWARD P. MAXTON, M. ASCE, Executive Vice President, De Long Engineering and Construction Co., New York, N.Y.

Prefabricated steel piers

A prefabricated, ocean-going steel pier is proving its merit at the United States Steel Corporation's Orinoco Mining Company iron-ore shipping station on the Orinoco River in the interior of Venezuela. The pier, fabricated in three sections each 377 ft long, has a total length of 1,131 ft and a width of 82 ft. Each section was fabricated in a Texas shipyard and towed 3,000 miles to the erection site. There the pier stands on circular steel caissons 6 ft in diameter, which were driven through wells in the hull of each barge-like section. (A similar four-section pier with a total length of 1,000 ft was towed 4,800 miles to the United States air base at Thule, Greenland, where it has been in service about two years.)

The unique feature of this pier construction method is the De Long Airjack, a jacking device which enables the steel pier sections to climb out of the water, up the steel caissons. Thus the pier is wholly supported by the caissons when the structure is completed.

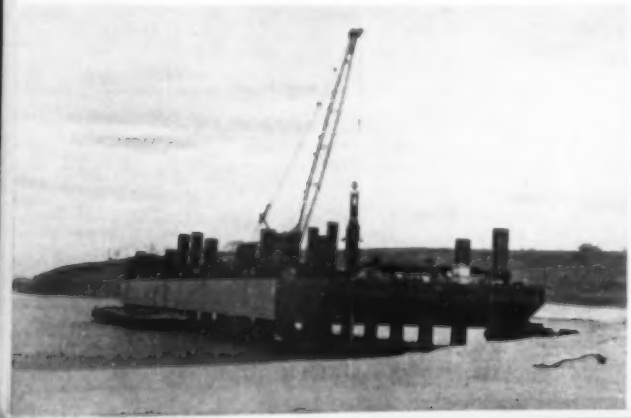
Each barge-shaped section of the pier is designed as a hollow box, compartmented for rigidity and safety in towing. Each is fitted with oil and water pipes, ship mooring devices, and tracks for a traveling crane and for loading conveyors. After launching, each section was loaded with its own 100-ft-long caissons, a crawler crane, air compressors, welding equipment, and all other gear necessary for complete erection of the structure. Because the barges are very stable while afloat, surplus cargo not essential to the erection of the pier was transported at the same time for the Orinoco Mining Co.

When a section arrived at the construction site, it was maneuvered into, and held in, approximate position until the crane on the deck could hoist the caissons and drop them through the holes in the deck. There the caissons were gripped by the DeLong Airjacks while the pier section was being moved into its precise position. The caissons were then dropped to the river bottom where they readily penetrated the sand and gravel overburden and became anchored.

The next step was the jacking up of the pier. The upper cylinder of

After pier section has been jacked up to desired elevation, caissons are released one at a time, driven to rock, and re-gripped by Airjacks. Caissons are then cut off flush with deck, welded to pier, and filled with sand and concrete.

Ocean-going freighter uses pier after it has been jacked to required elevation but before construction operations have been completed. Pier was in service a week after arrival of first section at site.



After launching, pier section is completely outfitted. Caissons are loaded on deck along with Model 4500 Manitowoc crane, and all other gear necessary for erection of pier. Launches and other cargo are being transported at same time for the owner.

At pier site, crawler crane on deck lifts caisson section preparatory to lowering it through deck, where it is to be gripped by DeLong Airjacks. When all caissons are held by jacks, barge-like pier section is positioned precisely, caissons are lowered to bottom, and section is jacked up out of water.

cut construction costs

each DeLong Airjack, which was attached to the deck of the section, gripped the circumference of each caisson. Then, in a manner similar to that of a small boy shinnying up a pole, the upper and lower cylinders of the jacks, joined by a tough rubber accordion-like band, lifted the barge section up out of the water. In each 2-min cycle, the Airjacks lifted the section about 6 in. The jacks are operated by compressed air through a master control and can be individually adjusted to level the deck. The master control can adjust the elevation to within $^{1}/_{32}$ in. The control piping is so designed that it is virtually impossible for the operating personnel to drop the section, nor will it fall if the air compressors or piping fail.

After the deck had reached its proper elevation and the weight of the pier section had forced the caissons down further, the jacks were released one at a time, and the caissons were driven to rock by a 200-C Super Vulcan hammer. After driving, each jack was reengaged. Finally the jacks were removed one at a time and the caissons cut off flush with the deck and welded to the section. The last step was to fill each caisson with concrete and sand and weld a cover plate over its top.

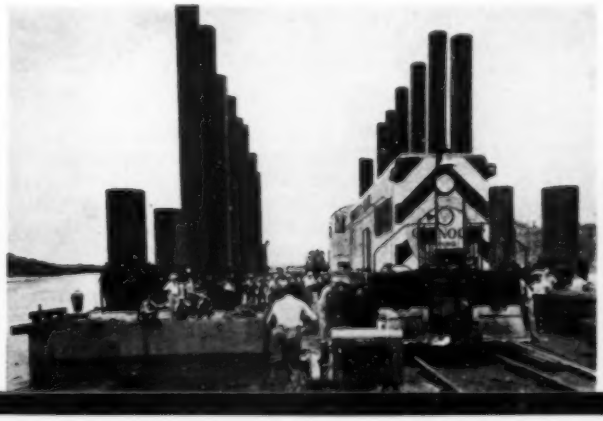
Field Construction Time Cut

This simplified operation cuts field erection time to about one-tenth that required for conventional pier construction. Total elapsed time from contract signing to completion of the structure has averaged four months on DeLong's projects so far.

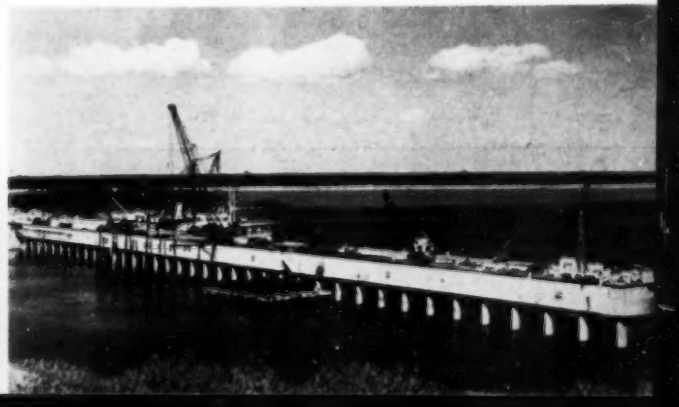
One of the economic advantages of this method of pier construction lies in the fact that the structure can be fabricated in any foreign shipyard to take advantage of local steel prices, local labor prices, and to shorten the length of tow. In the case of structures erected for temporary use it is an easy matter to remove a section after it has been placed; it is only necessary to jack the section down to the water, cut loose the supporting caissons and pull them, thus salvaging the entire structure at a minimum cost.

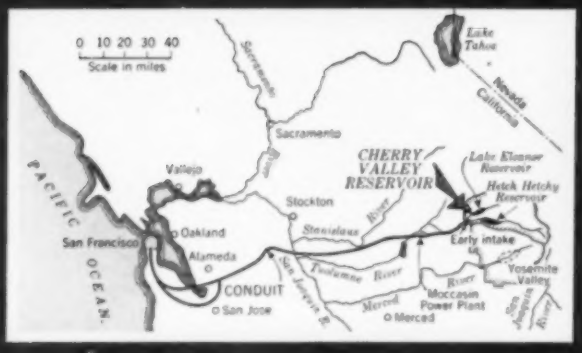
The Venezuelan structure here described was designed and erected by the DeLong Engineering and Construction Co. of New York.

End caissons of third pier section are dropped to act as spuds while 180-ton locomotives are unloaded. Locomotives were transported for owner.



Finished pier, located 180 miles up Orinoco River, is 82 × 1,131 ft. It will be used for loading iron ore onto 40,000-ton ocean-going ore boats as well as for incoming cargo. Fender system was later installed.





Construction starts on Cherry Valley Dam

FIG. 1. Cherry River Project, now under construction on western slope of Sierra Nevada in California, is newest unit in Hetch Hetchy water and power system.

TABLE I. Results of tests on impervious fill samples

Test	General Range of Results
Mechanical analysis classification	Silty sand to sandy silt
Liquid limit	27 to 33
Plasticity index	NP to 6
Specific gravity	2.70 to 2.76
Maximum dry density when compacted by:	
Standard AASHO method	106 to 120 lb per cu ft
Modified AASHO method	117 to 130 lb per cu ft
Ultimate ϕ in direct shear, when compacted to:	
100 percent of maximum density by standard AASHO method	27 deg to 30 deg
103 percent of maximum density by standard AASHO method	29 deg to 31 deg
Coefficient of permeability, K, when compacted to:	
100 percent of maximum density by standard AASHO method	0.004 to 0.20 ft per day
103 percent of maximum density by standard AASHO method	0.0007 to 0.06 ft per day

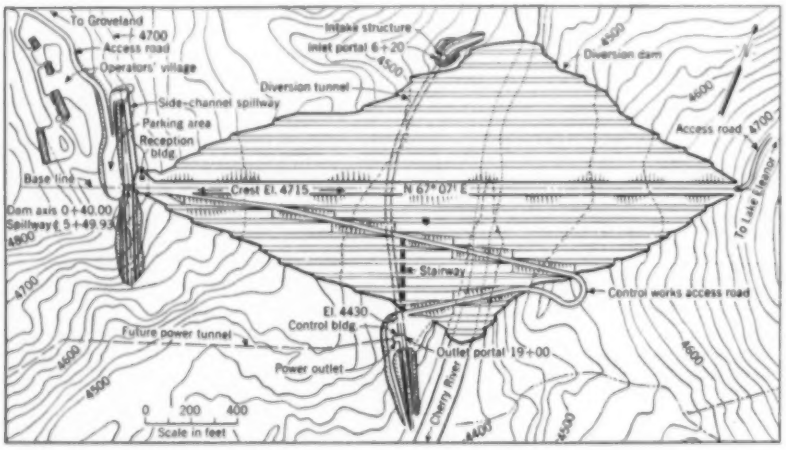


FIG. 2. Plan of Cherry Valley Dam shows location of low-level outlet works which runs through right abutment and will serve initially as diversion tunnel. Capacity of tunnel is 7,000 cfs. Foundation of dam is good granite.

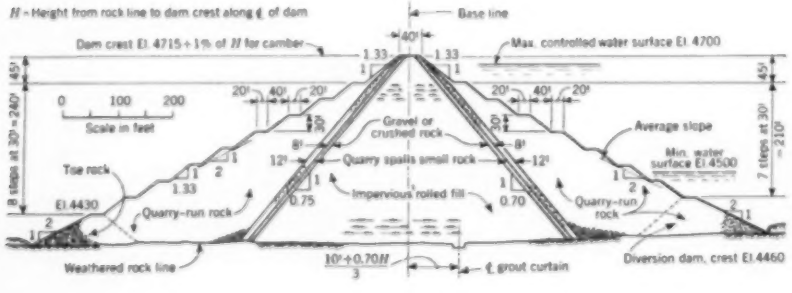

H = Height from rock line to dam crest along ℄ of dam
Base line
Dam crest El. 4715 + 1% of H for camber
Max. controlled water surface El. 4700
Scale in feet
Gravel or crushed rock
Average slope
Quarry spalls small rock
Min. water surface El. 4500
Toe rock
Impervious rolled fill
Quarry-run rock
El. 4430
Weathered rock line
℄ grout curtain
Diversion dam, crest El. 4460

FIG. 3. Originally planned as all rock fill, structure has been changed to earth and rock fill. Discovery of convenient source of disintegrated granite for impervious earth core led to change in plans. Structure rises 315 ft above stream bed.

The Cherry River Project is one of the long-planned step-by-step units of San Francisco's Hetch Hetchy water and power system. This most recent unit, a multi-purpose development for municipal water supply, flood control and hydroelectric power, is now under construction and is scheduled for completion in late 1954. The project will also create some incidental benefits to recreation, and will result in considerable benefits in both irrigation and power for the Modesto and Turlock Irrigation Districts.

Cherry Valley Dam is located on the Cherry River, a major tributary of the Tuolumne River, on the western slope of the Sierra Nevada of California. The location of the Cherry River Project and its relationship to the rest of the Hetch Hetchy power and water system is shown in Fig. 1.

The dam will be a composite earth and rock embankment with a height of about 315 ft above streambed and a length of about 2,600 ft along the crest. An uncontrolled side-channel spillway is located on the right abutment. The low-level outlet works is provided by a tunnel through the right abutment, to be used initially for river diversion during construction (Fig. 2). The reservoir will occupy a glacier-carved valley, about four miles in length, and will impound a total storage of approximately 270,000 acre-ft.

The power aqueduct, which is not included in the present construction, will take off from a branch of the low-level outlet works and will extend six miles down Cherry River Canyon, where it will drop 2,000 ft to the future powerhouse. This powerhouse will produce about 90,000 hp of continuous firm power. When the

(Vol. p. 308) 42

M. L. DICKINSON, M. ASCE, Chief Hydraulic Engineer, Bechtel Corp., San Francisco, Calif.

—newest unit in Hetch Hetchy system

Cherry River power development is completed, all water released from Cherry Valley Dam, except the small release for recreation purposes and the flood-water releases or spill, will pass through the Cherry River Powerhouse and another power development further downstream.

The dam is founded on granitic rock of various types which are excellent for foundation purposes. The site has been quarried and scoured by glacial action from a mass of ice estimated to have been at least 1,000 ft thick, which removed the weathered and softer rock. Only relatively minor weathering has occurred since the last glaciation. The overburden consists of a thin mantle of glacial soil and boulders averaging not over 5 ft in thickness. There are no detrimental fault zones.

Under a contract now in force, the entire dam site is being stripped of all overburden, loose bedrock and boulders, and as much of the weathered surface rock as may be required to uncover structurally sound rock. The stripping is being done by both mechanical and hydraulic means, with a final cleanup by high-pressure water jets. In addition to the general area stripping, a relatively shallow cutoff trench 20 ft wide is being excavated to rock of such tightness that the joints can be grouted economically. A continuous cutoff curtain in the foundation will be constructed along this trench by three-stage grouting.

Earth and Rock-Fill Section Chosen

Originally, in order to make the best use of local material, Cherry Valley Dam was planned as a full rock-fill structure with a reinforced-concrete face slab laid on a substantial cushion of large derrick-placed rock. Although the site was suitable for a concrete gravity dam, the transportation costs for the large quantity of cement required would have made this type extremely expensive.

In the course of the detailed geological investigations of the area extensive areas of decomposed granite were discovered downstream from the dam site within a radius of about two miles. This is below the lower limit of the most recent glaciation at the dam site. Investigations proved the decomposed granite to be suitable in quality and ample in quantity for an impervious core. Design studies indicated that a considerable saving in cost could be realized by changing from a full rock fill to an earth-and-rock design. Furthermore, this design would minimize maintenance costs.

The embankment section consists of a central earth core supported and protected by massive rock envelopes on both the upstream and downstream sides (Fig. 3). The earth core will have a slope of 0.70:1 on the upstream side and 0.75:1 on the downstream side, and a volume of about 3,000,000 cu yd. The quarry-run granitic rock envelopes, containing a volume of about 3,500,000 cu yd, will have an average slope of 2:1 on both upstream and downstream faces. The envelopes will be constructed, however, on the average natural angle of repose of the rock, with 20-ft-wide horizontal berms at 30-ft vertical intervals. This will save rehandling the surface rock during construction. An ample two-layer transition filter section will be placed on both faces between the earth core and the dumped rock to protect the core material from washing.

The impervious borrow areas were investigated by a total of 408 auger borings 12 in. in diameter and from 10 to 30 ft deep. On the basis of classification studies, nine 450-lb. composite samples were selected to represent the full range of materials in the two principal borrow areas. Extensive tests on these samples were made. Results are shown in Table I.

Several good quarry sites with practically unlimited quantities of sound granite rock are located close to both abutments of the dam. These sites were also investigated by core drilling. The borings showed a joint pattern which will produce rock of a desirable size range without the need for excessive secondary blasting.

Table II shows the characteristics of earth-core and dump rock-fill materials used for design.

Multi-Purpose Outlet Works Provided

The outlet works for Cherry Valley Dam is required to provide four functions:

1. **River Diversion During Construction.** A diversion capacity of 7,000 cfs is provided in the tunnel with the intake water surface at the top of the diversion dam.

2. **Flood Control.** Operating criteria for flood control discharges were prescribed by the Corps of Engineers. These required a flood-control discharge capacity of not less than 4,000 cfs at full reservoir, and not less than 3,000 cfs with the reservoir drawn down to provide 90,000 acre-ft of reserve storage space.

3. **Recreation and Fish Life.** As a result of negotiations with the U.S. Forest Service and the California State Fish and Wildlife Commission, it was agreed to provide water releases of from 5 to 15 cfs into the streambed below the dam at various times of the year.

TABLE II. Design characteristics of earth-core and rock-fill materials

Property	Minimum Quality Rolled-Earth Core	Rock Fill and Transition Sections
Dry weight	106 lb per cu ft	110 lb per cu ft
Saturated weight	131 lb per cu ft	132 lb per cu ft
Moist weight	122 lb per cu ft	...
Submerged weight	68 lb per cu ft	69 lb per cu ft
Angle of friction	27 deg	45 deg
Cohesion	0	0
Permeability	0.2 ft per day	Pervious

4. **Power.** On the basis of long-term studies, it was decided to provide a power discharge capacity of 450 cfs at minimum reservoir level.

In the interests of economy all these functions were served by providing a single low-level tunnel in the final design, and the controls were moved from the intake to the tunnel outlet. It is estimated that this arrangement saved nearly $1,500,000 over the preliminary design based on two separate tunnels with intake control towers.

Spillway Capacity Determined

On the basis of a study of available data for all floods having a peak flow of 2,000 cfs or more, it was estimated that the probable 1,000-year flood would have an instantaneous peak magnitude of at least 25,000 cfs, and might be as high as 35,000 cfs. A study of the theoretical possible maximum flood resulted in a theoretical peak runoff of about 60,000 cfs, which, when routed through the reservoir, would be reduced to a flow of about 52,000 cfs over the spillway.

On the basis of these studies, it was decided to provide a spillway that would pass at least 35,000 cfs with a normal minimum freeboard of not less than 5 ft, and 52,000 cfs with a reduced freeboard of 3 ft. To eliminate the possibility of a mechanical failure or human error, the spillway is to be of the ungated, free-overflow crest type.

Extensive tests of a 1:40 scale hydraulic model of the side-channel spillway were made in a small hydraulic laboratory especially constructed for the purpose at San Francisco's Moccasin Creek Powerhouse, where an adequate water supply was available. These tests indicated many improvements over the preliminary layout, and resulted in both improved operations and substantial savings in cost. Some of the principal changes made as a result of the model tests are:

1. The approach excavation to the overflow weir was reduced.

2. The bottom width of the overflow channel behind the weir was changed from a uniform width of 50 ft to a width tapering from 25 ft at the upstream end to 54 ft at the beginning of the transition.

3. The right or uphill side of the spillway channel was made a continuous straight surface on a $\frac{1}{4}$:1 side slope throughout the overflow section, the transition, and the chute.

4. The transition between the overflow section and the chute was accomplished by a vertical cylindrical quadrant on the left or dam side, with a 5-ft-high step across the channel bottom.

5. The chute portion of the spillway was flattened from a 20-percent to a 5-percent grade.

Present Status of Project

Completed sections of the Cherry River Project are the 25-mile-long, 18-ft-wide, asphalt-surfaced access road; the 10-mile-long, 22-kv, wood-pole, power-distribution line; and the permanent operators' village at the dam site, which will be used as a base for field engineering and administration of the construction work.

First stage construction of the diversion tunnel, including the base of the intake tower, clearing and stripping the dam site, excavating the cutoff trench, and grouting the foundation, are under way with completion scheduled for the summer of 1953 at the end of the high-flow season. It is planned to start construction of the rolled-earth core and dumped rock fill, and excavation of the spillway channel in the spring of 1953. This will be a two-season job. Concreting of the spillway, final stage construction of the outlet works, installation of the valves, and miscellaneous minor work will be completed in 1954.

Completion of the power facilities is dependent on authorization of additional bond funds.

The Hetch Hetchy Project is one of the utilities under the jurisdiction of the San Francisco Public Utilities Commission. James H. Turner, M. ASCE, is Manager of Utilities. Harry E. Lloyd, M. ASCE, is Manager and Chief Engineer of the Hetch Hetchy Water Supply, Power and Utilities Engineering Bureau. The writer was Design and Construction Engineer for the Cherry River Project until August 1, 1952. Since that time Oral L. Moore, J. M. ASCE, has been Construction Engineer, and Wesley F. Getts, M. ASCE, Design Engineer. The Board of Consultants for design and construction of the Cherry River Project consists of Walter L. Huber, President, ASCE; A. Kempkey, M. ASCE; and I. C. Steele, M. ASCE. John K. Vennard, A. M. ASCE, was special consultant on the hydraulic laboratory work.

(This article has been prepared from the paper presented by Mr. Dickinson before a Power Division session at ASCE's San Francisco Convention. This session was presided over by H. V. Lutge, a member of the Division's Executive Committee. The original paper is Convention Preprint 71.)

How would you do it?

Some of the most fascinating chapters in the life and memory of an engineer are those which deal with the unusual and unexpected situations which almost got him down but from which he finally emerged the victor—H. J. Gilkey

When a building is to be increased in height, the columns and foundations need to be investigated and usually strengthened to carry the additional floor loads. In one such instance it was found that the salaried employee of the engineering firm responsible for the original design of the building had, on his own initiative, provided enough added foundation and column strength to carry the two supplementary floors that were needed.

Obviously the engineer, the architect and the owner were pleased at the discovery since a considerable sum of money was saved through the "unauthorized foresight" of the employee. Was the employee to be commended or censored? For the solution, see page ??

EDITOR'S NOTE: This is the fourteenth in a series which started in the February 1952 issue of CIVIL ENGINEERING. In the April 1952 issue an article, "The Unexpected in Engineering: The Bugs," explains the project and enlarges upon the central theme that problems of the past created the practice of the present; that "The engineering of today rests upon a coral reef; sturdy remnants of yesterday's bugs." The process is a continuing one; there will always be today's and tomorrow's bugs to add zest and gray hairs to the practice of a profession that by its very nature must cantilever from a codified past to an untried future. "Long live bugs" is an ever-present challenge to the virility and ingenuity of the engineer. If you have a good bug, why not share it? H.J.G.

LAW

Legal responsibility of the registered engineer

WALTER C. SADLER, M. ASCE
Civil Engineer and Attorney-at-Law, Ann Arbor, Mich.

Engineering works are designed for the use and benefit of society, and for this reason they must be safe and functional. The owner of large engineering jobs has made a very substantial investment, and he is personally concerned with the structure or plant which he has financed. But examination will disclose a number of other parties with concurrent interests.

Owner's Responsibility. The owner has a responsibility to business invitees who come onto his property, such as those who enter his store, office building, or amusement stands. This invited public may be injured by poor design, defective construction, or under-maintenance. The owner may also have operational failures, as where an electric power plant fails to produce the anticipated quality or quantity of public service.

Similarly, the owner may experience unexpected costs due to the inefficiency, incapacity, or high maintenance of his metropolitan terminals, buildings, bridges, or toll highways.

Finally, the normal use of the property may cause injuries to neighboring lands, plants, or persons. Such an unhappy project owner is usually an industrial corporation or business concern and may be rather anxious to seek reimbursement from his building contractor or from the engineering firm that did the design.

Contractor's Responsibility. The builder's relation with the owner is contractual, and the project owner's relief is based on the terms of the agreement. This is a topic beyond our present consideration. While fraud may be additional grounds for an owner's recovery, the scattered cases of dishonesty in construction are so isolated as to warrant the dismissal of that phase of the subject from consideration here.

Potential Engineering Failures or Difficulties. Before we take up engineering responsibilities in general, a few practical cases should be examined:

1. Smokejacks are not watertight, resulting in serious leaks.

2. A motor vehicle turns off the pavement on a bridge approach, twists in the soft shoulder, and plunges over the bank. There was no guard rail. The factors necessitating a guard rail would include class of road, width, curves, shoulders, speed, motor vehicles using it, and distance of vision.

3. A slippery stretch of asphalt pavement on a heavily traveled route causes an accident.

4. A structure proves insufficient to support load, as where a usual load is not provided for or an unexpected or illegal load concentration causes a failure.

5. A long bridge of novel design and economical proportions fails during anticipated weather conditions.

6. Insufficient spillway results in overflowing of an earth dam, resulting in complete failure. There is an issue of fact as to engineering analyses of stream flow in this locality.

7. Specifications designate difficult, impracticable procedures for authorizing work changes, with the result that the contractor ignores the routine.

8. A downstream manufacturer, after obtaining proper authority, erects flashboards on a government dam, thereby flooding out an upstream tailrace and ultimately incurring extensive expense in reimbursing the injured upstream power plant.

9. A state possesses complete borings which show quicksand pockets but lets a foundation job without disclosing its full knowledge. The contractor is led wrongfully to believe the job is similar to other ordinary jobs in the vicinity.

10. A state has complete borings, gives each bidder all its data, warns that borings indicate substantial boulder pockets, and invites the contractor's engineers to see and study the boring material. The excavations uncover extensive and very costly boulder pockets.

11. A railroad bridge and a power plant on the Mississippi River are somewhat concurrently conceived and promoted. The railroad bridge is slightly downstream from the power house, and because of the position of the tailrace, the west-end bridge piers must be materially strengthened at considerable cost. The railroad has right-of-way easements, and hence riparian rights, and possesses appropriate river-crossing papers from the Corps of Engineers. Although the FPC authorization was technically at fault in allowing this problem to arise, the power company's legal position was weakened by the engineering design, which changed the normal flow of the stream to the detriment of a lower riparian owner, the railroad.

The above eleven cases resulted in damages, some of the losses being of substantial proportions, and it is possible that every one might have been avoided by proper engineering or legal advice. Directly or indirectly, each case involves the question, "Should the engineer be personally liable under the circumstances?"

The Engineer's Responsibility. The engineer may perform his work as an independent contractor, as an agent with the capacity of a fiduciary, or as an employee. In each case the engineer's duties require diligence, due care, skill, and judgment. If he is lacking in the first three, he is negligent, careless, and a misrepresenter of his ability. The engineer's conduct and accomplishments are considered in the light of all the circumstances.

The more extensive experience an engineer has had and the more training and reputation he possesses, the greater his fee or salary and consequently the greater the reliance the owner may place on his engineering services. For instance, the duly registered engineer has qualified as to standards of education, experience, and ability. He has fully satisfied statutory provisions which are very strict, and as a token of this he possesses papers, a common seal, and a legal title which are statutorily denied to all others.

In the case of an engineering failure the designer, or construction engineer, is not held to perfection. Some mathematical errors are excusable. But he must meet the reasonable standard performed by the average engineer with his qualifications. Legally, the issue is a question of fact for a jury.

Engineers designing in new fields are often called upon to pass judgment and to make decisions which are not subject to precise analyses. The problems have passed beyond routine skill, to judgment. It is stated that an engineer is not responsible for an error in judgment. Similarly, the task of engineering does not guarantee the result.

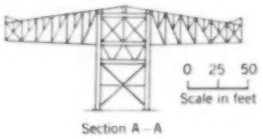
The scarcity of litigation against the engineering profession speaks well for the long record of competent service performed by the profession, but it would be foolish to deny that engineers do face some legal risk in their scientific pursuits.

MURRAY A. WILSON, M. ASCE

Wilson & Company, Engineers, Salina, Kans.

BELOW: Long-span steel trusses support transverse cantilever trusses. Longitudinal trusses were erected completely before riveting began. Bottom-chord column connections were not made until roof trusses and roof were complete.

ABOVE: Unobstructed work area large enough to accommodate twelve B-47 bombers was basic consideration in adopting this style of framing. Extra weight of steel required was justified by large area provided.



Section A - A

Long trusses and steel cantilevers provide

Faced with expansion of its Wichita Kans., operations for the building of B-47's, the Boeing Airplane Company found that its most urgent need was to provide space for the aircraft after their assembly. In the new structure the final touches would be added to ready the ships for test flights. Early in 1951 approval was received from the Air Materiel Command for the construction of a flight hangar, and working drawings were started immediately.

The basic requirement for the hangar was an area sufficient to accommodate twelve B-47 airplanes simultaneously, with ample working space around them for finishing operations. In addition, there were other needs, including shop space, office space, and facilities for personnel, including a cafeteria. Because of its location, the use for which it is designed, and the soil on which it stands, the resulting structure has some features that are unusual if not unique.

The building, 195 ft wide and 946 ft long, is divided into five sections, from north to south as follows: The first section is a two-story steel frame 94 ft long, with brick walls and concrete roof, housing the shop area, boiler room and cafeteria on the ground floor, and office space on the second floor. Sections two and three are two bays of hangar space, each 265 × 195 ft. The fourth section is another shop area 40 ft wide, built inside the hangar and covered by the hangar roof. Although only one story was built, it is designed to carry two more stories as required. The fifth section is another bay of hangar space, 265 ft long.

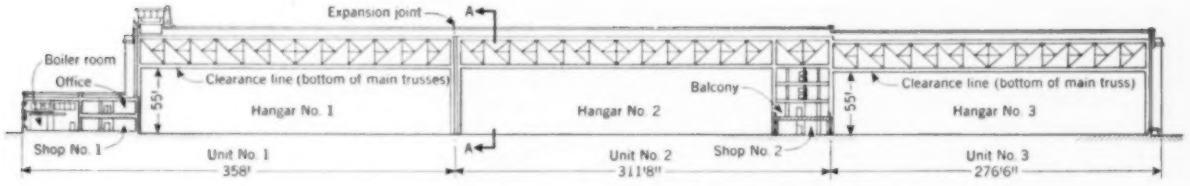
Cantilever Roof Construction

It was required that the space inside the hangar have as few obstructions as possible, with an absolute maximum of clear, usable space, both for working and for maneuvering the large planes. As a result of these requirements a cantilever type of roof construction, with no supports along the outer walls, was chosen. The frame consists essentially of a pair of longitudinal trusses spaced 40 ft on centers and supported on columns at their ends. Perpendicular to the longitudinal trusses are the cantilevered roof trusses, which project a distance of 75 ft from their supports.

Many different combinations of framing were studied before the final decision was made. Although the type chosen was not the most economical in overall weight of steel, the extra cost was believed justified considering the necessity of having a maximum of clear working space and of maneuverability. It was felt, in fact, that the chosen design would, in the end, be the most economical for the intended use. When the general conformation and arrangement of the trusses had been decided on, the advisability of using continuous trusses for the longitudinal members was

BELOW: FIG. 1. Overall length of Boeing's Wichita flight hangar is 946 ft. Main longitudinal trusses have clear span of 263 ft. Width of structure is 195 ft with 55 ft of clearance under trusses.

ABOVE: Flight hangars at Wichita, Kans., were built to provide added capacity for Boeing Airplane Co.'s expanding operations. Final work on assembled planes before test flights is performed in this structure.



open work area for Boeing flight hangar

studied. The character of the soil, which made it probable that there would be some settlement and that such settlement would be unequal, led to the choice of simple trusses for the main members.

Footing Loads Limited

The soil in this area is alluvial silt and clay. Thirty test borings were made over the area, and four bearing tests were conducted at the approximate elevation of the bottom of the footings. As a result of these tests, it was decided that the total load on the footings must be limited to 1 ton per sq ft. This condition suggested the advisability of supporting the structure on piling. However, a study of comparative costs, and consideration of the possible delays which the use of piling might entail, led to the choice of simple reinforced concrete foundation slabs, so proportioned that the maximum total load would not exceed the specified 1 ton per sq ft.

All reinforced concrete in the structure was designed for the following working stresses: reinforcing steel, 20,000 psi; concrete, 1,050 psi; shear, 75 psi; and bond, 240 psi. The two largest of the footings are each designed to take the load of four columns, that is, to carry 1,365 kips. Each is 92 ft long, 50 ft wide, and 5 ft 6 in. high, and has a total cross-sectional area of steel in the longitudinal direction of 302 sq in. and in the transverse direction of 430 sq in. The next smaller size footing is 60 ft long by 40 ft 3 in. wide and 3 ft 5 in. high. The longitudinal reinforcing steel in these footings totals 147 sq in., while the transverse reinforcement has a cross-sectional area of 280 sq in. The remainder of the column footings are much smaller but were designed for the same type of loading.

The main trusses, which have a clear span of 263 ft, consist of ten interior panels each 22 ft long and two end panels each 21 ft 6 in. long. Each truss is 24 ft deep, center to center of chords, weighs 1,300 lb per lin ft, and carries a total load, not including wind loading, of 1,680,000 lb. The trusses were shop assembled before shipment, and final assembly was accomplished in place in the field. To approximate the reactions of a simple truss, the lower-chord column connections were left blank and were drilled in the field after the roof trusses and roof were in place.

The hangar floor was poured before steel was erected, thus simplifying the problems of supporting the falsework for erection. The steel oilfield derricks used as falsework could be skidded from place to place as needed. The floor was protected by a layer of paper covered with a 2-in. layer of sand. This protection proved adequate, and only minor surface damage occurred, caused principally by rivets discarded by the riveting crews when they were encountered by the treads of the crane.

Erection was accomplished by a special crane mounted on rails and equipped with a boom having a total length of 100 ft. Erection started at the north end, and progressed southward. After the office and shop section was completed, the first two main columns were set in place and the erection of the main trusses began. First the trusses were erected complete, and then they were riveted, starting from one end and working toward the other. After the first pair of trusses was completely riveted except for the bottom-chord connections, erection of the cantilever trusses began, again proceeding from north to south. The transverse roof trusses were connected across the main truss, to increase stability and provide sway bracing. Each transverse truss was located at the panel points of the main trusses. At each pair of columns at the ends of the main trusses, the portal, or basic sway bracing, was installed, designed to take the total wind load on the building.

The columns were completely fabricated in the shop and, as received on the site, weighed 43 tons. The crane on the job was capable of picking up one of these columns and setting it in place. Detailing of columns and trusses followed standard practice for bridge construction, using standard shapes, augmented by plates as required to attain the necessary sections.

The doors, which occupy the full length of the hangar on both sides, are of the rising canopy type. Each door is 66 ft wide, covering three panels of the main truss, and is suspended from the ends of three roof trusses. Each 47-ton section of the door is in two parts, a lower leaf and an upper leaf. When the door is opened, the lower leaf rises until its lower edge coincides with the lower edge of the upper section, then both sections revolve outward and upward until they reach a horizontal position. When open, the doors have a minimum clearance above the floor of 55 ft. Each door is operated by an individual motor and controlled by push buttons located at the ends of the hangar. The doors were designed and fabricated by the International Steel Co. of Evansville, Ind.

When the hangar design was begun, it was planned to use the rolling type of door, supported on tracks cast in the floor, but site conditions precluded this. The site is adjacent to an existing paved area which has a slope, parallel to the longitudinal direction of the hangar, of approximately 0.006 ft per ft. To meet this condition the floor of the hangar was given a slope of 0.004 ft per ft in the same direction, the maximum that could be permitted considering the work to be done in the hangar. Differences between the floor and the existing paved area were taken up in the shop areas by means of ramps as required. With the suspended type of door, the slope of the floor created no difficulty, as the lower leaf of the door was fabricated to fit the slope.

The entire hangar (except section one), including roof, sides, ends, and doors, was covered with asbestos-protected metal, as manufactured by the H. H. Robertson Co., Pittsburgh, Pa.

All the metal walls and roof are insulated with one inch of glass fiber blanket. The roof, covering an area in excess of four acres, presented some problems in providing for storm-water drainage. Downspouts were designed to handle rainfall at the rate of 6 in. per hour, with a total capacity of 1,500 cfm, or 25 cfs.

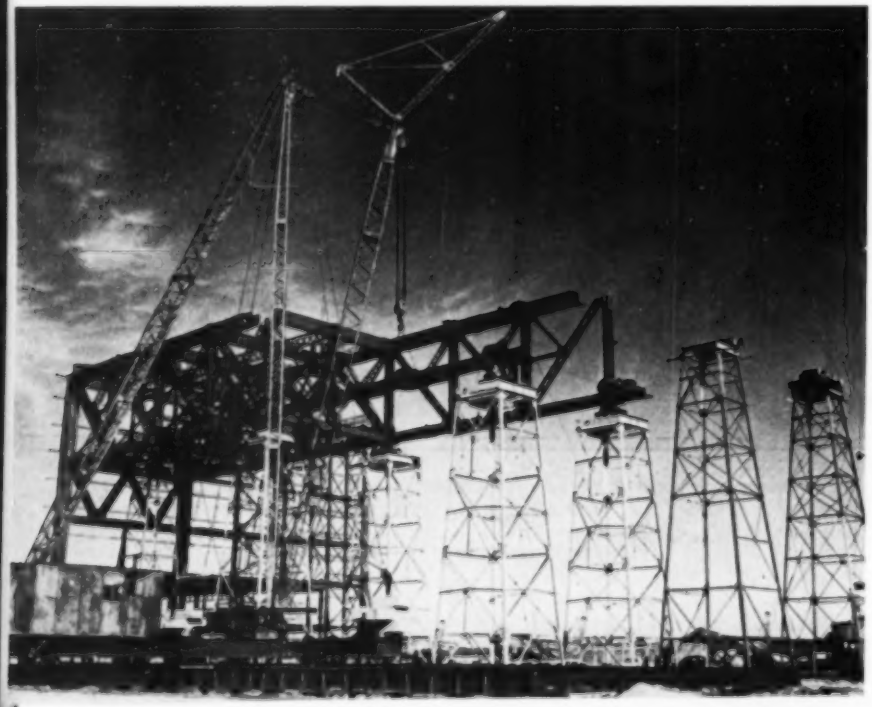
The heating system is designed to provide an indoor temperature of 70 deg F, with the outside temperature at minus 10 deg F and a wind velocity of 15 mph. Boilers are normally fired with natural gas, with dual burners suitable for oil as a standby. An underground concrete tank, with a capacity of 100,000 gal, was provided for the storage of oil, to be available at any time the gas pressure becomes insufficient to maintain the required amount of heat.

Bids for the construction of the hangar were opened on July 6, 1951. Of the eight bids received, the lowest was that of the Manhattan Construction Co. of Muskogee, Okla., in the amount of $2,595,396.50. The contract was awarded to them and work started promptly. The building was substantially complete by October 1, 1952, and entirely complete by November 1, 1952.

Material furnished to the contractor by Boeing consisted of the following: Structural steel from the Mosher Steel Co. of Houston, Tex.; roofing and siding from the H. H. Robertson Co. of Pittsburgh, Pa.; and the doors from the International Steel Co. of Evansville, Ind. Manhattan subcontracted the erection of these three items to the Beasley Bros. Construction Co. of Muskogee, Okla.

The building was designed by Wilson & Co., engineers of Salina, Kans., under the direction of H. H. Connell, M. ASCE, chief engineer. Architectural features were designed by Gilbert L. Geery, A.I.A., chief architect; footings by David L. Von Niederhausern, J. M. ASCE; and structural steel by George K. Fitch. The supervision of construction was under the general direction of L. R. King, A. M. ASCE, with Charles P. Cathers, M. ASCE, in direct charge of the hangar. Total construction cost of the building was $4,700,000.

Steel oilfield derricks were used as falsework for erection of trusses. Derricks were skidded across previously poured, sand-covered, concrete floor. Crane with 100-ft boom, used for erection, was mounted on rails.



(Vol. p. 314)

Hydraulics laboratory equipment demonstrates fundamental principles of flow

Apparatus developed for study of laminar and turbulent flow

D. E. METZLER

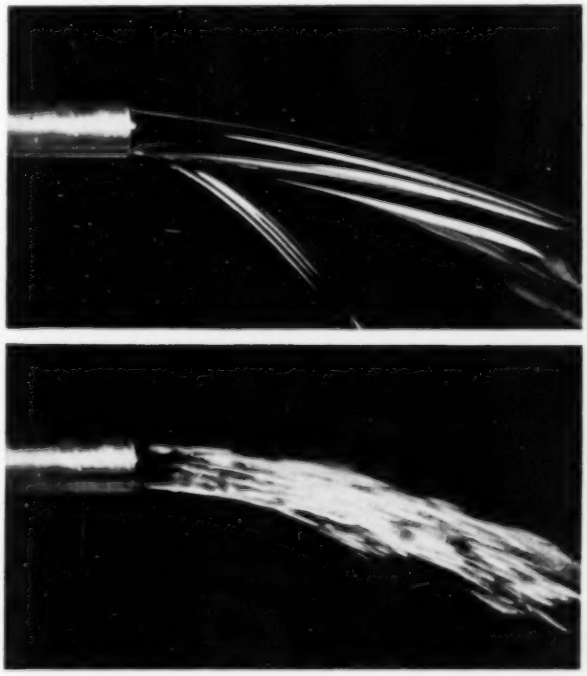
Associate Professor, Department of Mechanics and Hydraulics; Research Engineer, Iowa Institute of Hydraulic Research, State University of Iowa, Iowa City, Iowa

One trend in engineering curricula is the broadening of undergraduate instruction in hydraulics. An essential part of this trend is the shift in emphasis in the laboratory courses from the calibration and use of instruments to the demonstration of the fundamental principles of flow. But the necessary changes in laboratory equipment have, so far, occurred only sporadically. As the implementation of this change is in keeping with its purpose of promoting the study of basic problems in the flow of liquids and gases, the Committee on Fluid Dynamics of the Engineering Mechanics Division is, in this and subsequent issues, presenting descriptions of several effective instructional units.

John S. McNown, Chairman

To demonstrate the difference between laminar and turbulent flow in smooth pipes, an oil-recirculating unit was added to the student laboratory of the Iowa Institute of Hydraulic Research in 1941. Although this unit was primarily intended for laboratory instruction of undergraduate and graduate students of fluid mechanics, it also has been effectively used for advanced research and for introductory demonstrations. Visitors usually single out this apparatus as the most interesting part of the student laboratory equipment. Its value for instructional purposes is indicated by the fact that a number of other educational institutions have installed or are in the process of constructing similar units.

The apparatus consists in brief of a storage tank, centrifugal pump, approach section, test pipe, transparent outlet hood, and weighing tank, forming a closed circuit for the recirculation of oil as shown schematically in Fig. 1. At the outlet end of the 6-in.-dia approach is a bell-mouth entrance to the test pipe. The latter, made of standard $^3/_4$-in. brass pipe, is provided with 9 piezometer openings at increasing intervals along its 15-ft length, and a stagnation tube with rack-and-pinion drive is located 1 ft from the downstream end.



Oil jet provides visual demonstration of difference between laminar flow (above) and turbulent flow (below). For sharper detail in photos, plastic hood was removed from apparatus.

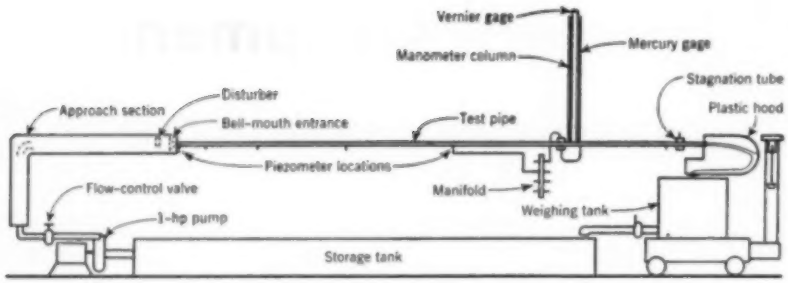


FIG. 1. Schematic diagram indicates general nature of hydraulic apparatus.

Each piezometer opening is connected by copper leads to a valved manifold, and thence to either an open-tube manometer column or a zero-displacement mercury gage. Immediately before the streamlined entrance is a disturber in the form of a semicircular brass strip, which serves as an optional source of initial eddies. The disturber can be swung into the flow directly in front of the bell-mouth entrance or can be made ineffective by being turned toward the wall of the approach section. At the downstream end of the test pipe, a transparent hood is used to guide the oil jet into the weighing tank on the platform scales so as to permit unobstructed observations. This hood is removable for photographic work.

Through use of a commercial mineral oil having a viscosity about ten times that of water, Reynolds numbers ($\mathbf{R} = VD/\nu$) between the approximate limits of 100 and 8,000 can be obtained in the test pipe. Although the streamlining of the entrance and stilling in the approach section are sufficiently complete for laminar flow to persist over the entire range of Reynolds numbers, turbulent flow will occur in the upper range if the disturber is placed directly in front of the bell-mouth entrance. The flow will then remain laminar only up to the lower critical Reynolds number of about 2,000.

FIELD HINTS

Simplified method for preliminary hydrographic surveys of calm waters

ROBERT D. SCHACHERL, A.M. ASCE, Bridge Engineer, Knappen-Tippetts-Abbett-McCarthy, Engineers, Cochabamba, Bolivia

With the prevailing shortage of engineering personnel it may be of interest to present a seldom used but highly expedient and economic procedure for approximately locating points on a relatively tranquil, horizontal water surface. This method requires the use of only one transit or plane table (with its operator), set up as high as possible above the water level. If the vertical distance H between the water level and the horizontal axis of the instrument is known, the horizontal distance D to any point sighted at water level can be computed approximately by multiplying H by cotangent α, the vertical angle of sight.

Mr. Vittorio Aloisio, civil engeneer and contractor at La Paz, Bolivia, has used this method successfully to determine the outline of a lake of considerable size, using only one transit station established on a hilly island in the lake, and sighting an adequate number of points on the water level contour at distances far beyond the reach of stadia readings. And now Mr. Jorge Berindoague, civil engineer with Knappen-Tippetts-Abbett-McCarthy, Engineers, proposes to adopt the same method for determining the positions of a boat during soundings. For this purpose the writer suggests the use of an easily seen target fixed in the center of the boat slightly above the gunwales. In this case H is the constant difference in elevation between the horizontal axis of the instrument and the target, or in other words, the difference in elevation between the horizontal axis of the instrument and the water surface minus the elevation of the target above the water surface (Fig. 1).

If not much accuracy is required, this method can be used when the water surface is slightly rough, by setting the horizontal crosshair so as to see the target oscillating symmetrically about it.

To decide in which cases the method is suitable, the writer suggests an analysis of its accuracy under different conditions. As H always can be determined accurately by careful leveling, the major sources of error are restricted to: (1) sighting on a point slightly above or below the true target elevation, and (2) reading the vertical angle α inaccurately.

To compute the probable amount of the first error proceed as follows. From Fig. 2, in which B represents the target, it can be seen that if the point sighted in the amount h above or below the true target elevation and the resulting error of D is called d, by

Observation of the oil jet through the Lucite outlet hood reveals a very striking difference between laminar and turbulent flow. As seen in the photographs (page 49), the surface of the laminar jet is so smooth and unwavering that it appears almost as if it were molded from glass, whereas the turbulent jet has the familiar rough and opaque surface appearance of the stream from a garden hose.

In a typical undergraduate laboratory experiment the apparatus is used to determine characteristics of both laminar and turbulent motion in the zone of established flow. From the experimental data, the form of the velocity distribution, the ratio of the maximum to average velocity, and the rate of energy loss can be compared for the two regimes of flow. Finally, the values of the experimental resistance coefficients can be compared with those obtained from the equations of Poiseuille and Blasius (Fig. 2).

In laboratory classes conducted for graduate students, the oil unit is used to evaluate flow characteristics in the zone of establishment and to study the distribution of velocity and intensity of shear in the expanding boundary layer.

At the time of its initial construction, the cost of the unit was held to a few hundred dollars by utilizing pipe, structural shapes, and scales already at hand. Various refinements were added in succeeding years. Although it is estimated that at present prices for new parts, the replacement cost would be about $2,000, the primary unit could be constructed by a laboratory mechanic for perhaps a third of this amount.

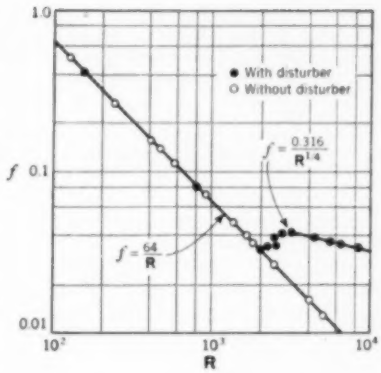


FIG. 2. Results of typical student experiment are plotted to show variation of resistance coefficient with Reynolds number.

practical similarity of triangles ABC, A_1BC_1 and A_2BC_2, the following proportion holds: $d:h = D:H$, hence $d = \frac{h}{H} D$, and the percentage of error is practically independent of the distance D and only a function of the proportion h/H. For example, if h amounts to 0.2 ft, and H equals 30.0 ft, the factor of error is $\frac{0.2}{30.0} = 0.67$ percent.

This sort of error can be kept very low when the water surface is completely calm.

The second type of error, induced by inaccuracies in reading the vertical angle α, varies as shown in Fig. 3, for different proportions of D/H. The percentages of error shown correspond to an inaccuracy of α of 1 min. By using instruments reading vertical angles closer than to 1 min, these percentages are reduced proportionally.

The foregoing discussion shows that the survey method outlined is particularly advantageous for use on lakes surrounded by hills or mountains, which provide low D/H and h/H ratios, thus increasing the accuracy of the results. This condition is often encountered on lakes connected with hydroelectric projects.

FIG. 1. Simple method utilizes single transit or plane table sighting on target set up on boat.

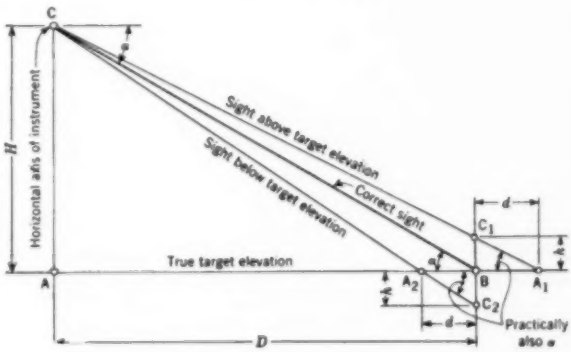


FIG. 2. Percentage of error due to sighting on point slightly above or below true target elevation is shown to be practically independent of distance D and only a function of the proportion h/H.

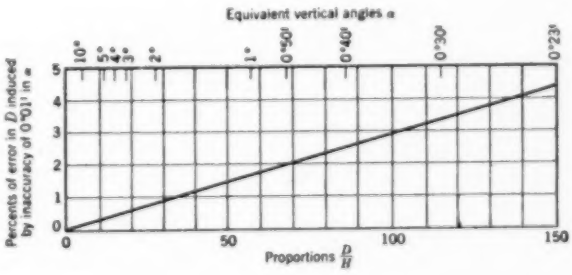


FIG. 3. Inaccuracies induced by misreading of angle α by 1 min are shown graphically. For inaccuracies in α different from 0°1', percentage of error of D varies practically proportionally to variation in accuracy of α.

ENGINEERS' NOTEBOOK

Stresses in frame of Grand Coulee Pumping Plant

Adoption of a construction procedure causing prestress in the frames of the Grand Coulee Pumping Plant, a technique not usually called for, made possible a 20-percent reduction in stresses in the columns between the plant's two major floors. The pumping plant structure, on the Bureau of Reclamation's Columbia Basin Project in Washington, was completed in November 1951. Four of the 65,000-hp, 1,350-cfs pumps have already been installed, and work is proceeding on two more of the ultimate total of 12 pumping units. (See CIVIL ENGINEERING, June 1951.)

The Grand Coulee Pumping Plant's two major floors are illustrated as BC and EF in Fig. 1. As the floors are of long span, relatively close together, large shear stresses and bending moments are set up in the short columns (BE and CF) between the floors. A sloping ramp requires a seat at "F" at different elevations for the main frames, and the reentrant corner at this ramp seat causes additional concentration of stress.

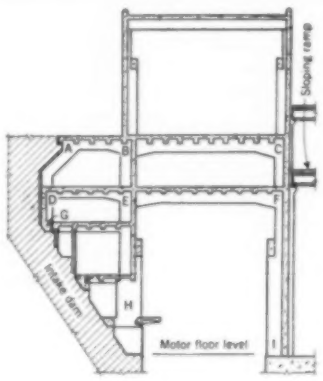


FIG. 1

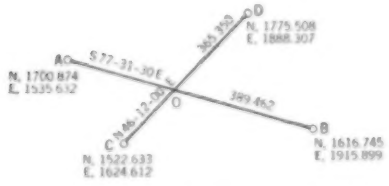
A study of the moments induced by the loads on the two floors indicated that loads on both floors would cause additive stresses in the columns, as shown in Figs. 2 and 3. Therefore, if a reverse load or an equivalent effect were introduced on one of the floors, the stresses in the columns would be correspondingly reduced. The following procedure of placing concrete was adopted to accomplish this result.

THE READERS WRITE

Readers Send Other Solutions for Intersection of Two Lines

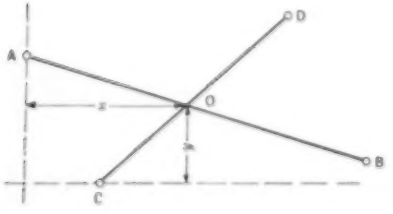
TO THE EDITOR: In your March 1953 issue (pages 62 and 63), Les Clarke discusses a "Simple Method for Computing the Intersection of Two Lines." The following is a simpler method, which I have been using with much success and little effort.

Given (see Fig. 1, below):



1. Coordinates of points A, B, C, and D.
2. Lengths and bearings of lines AB and CD.

To find: Coordinates of the point of intersection O (see Fig. 2, below):



Solution: Establish coordinate lines through points A and C. Determine new coordinates for points A and C.

A = 0, 178.241
C = 88.980, 0

From bearings, slope line AB = −0.2212369 and slope line CD = +0.9589655

Equation for line AB is

$$-0.2212369x - y = -178.241$$

Equation for line CD is

$$0.9589655x - y = 85.3287502$$

Solving these: $x = 223.32588$; $y = 128.8330746$.

Therefore the coordinates of point O are N 1,651.466 and E 1,758.958.

It is now a simple matter to find the lengths of lines AO, OB, CO and OD.

WILLIAM DAVIS, M. ASCE
Civil Engineer, Board of Water Supply, City of New York

Downsville, N.Y.

TO THE EDITOR: The article by Les Clarke, "Intersection of Two Lines Computed by Simple Method" (March 1953, p. 62), was read by me with great interest, as I have had to solve problems of this sort frequently in the past.

My method of solving this problem is as follows:

The intersection of two lines of known bearing, one point on each line being described by coordinates, is found by solving for the course and distance between the two known points, then solving the resulting triangle by application of the law of sines. A closure should be run around the resulting triangle, both as a check and to obtain the coordinates of the point of intersection.

I believe this method to be as simple as the one outlined in Mr. Clarke's article.

R. F. WINSTON
Professional Engineer and Surveyor

Lake Jackson, Tex.

Shear Keys Called Ineffective and Unnecessary

TO THE EDITOR: It is a very interesting idea regarding shear keys that Mr. Schwartz presents in his letter in the March 1953 issue (p. 65), discussing my article, "Steel

ERIK J. SOLLID, M. ASCE

Engineer, Bureau of Reclamation, Denver, Colo.

reduced by construction procedure

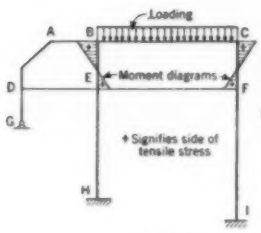


FIG. 2

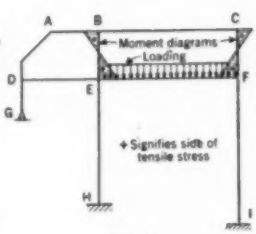


FIG. 3

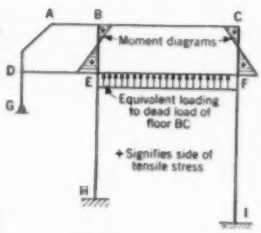


FIG. 4

Shoring under the lower floor, floor EF, was left in place for 21 days—or long enough to develop a strength of 3,000 psi in the concrete. By placing the shoring for the upper floor, BC, from the lower floor and removing the shoring under the lower floor before placing concrete in the upper floor, the whole dead load of the upper floor was transmitted to the lower floor. This load did not cause any stress in columns BE and CF since the upper frame had not yet hardened to the point of monolithic stability. In this way, the frame had no stress in the members above floor EF but had an initial stress in the frame below floor EF caused by the load from floor BC. As the shoring under the upper floor was removed, thus removing the load from EF, the lower floor deflected upward as if a load had been introduced beneath it equal to the dead load of the upper floor.

This loading effect is illustrated in Fig. 4. In this way, the frame was constructed having a prestress in columns BE and CF of opposite sign to that caused by the floor loads, as shown in Figs. 2 and 3. The final stresses in the columns were, as a result, reduced about 20 percent. Stresses in the column sections below the lower floor were not materially increased.

Girders Hung from Concrete Cantilevers," in the December 1952 issue (p. 25). Mr. Schwartz's idea is that shear keys in vertical construction joints which are squarely perpendicular to the direction of principal stress in beams or girders do indeed develop shearing stresses on their rough sides and thereby help hold the jointed parts together. By so doing they prevent "exposure to the elements" being suffered by the reinforcing bars which cross the joint. Probably in keeping with the implied hazard, it would be better to say "span" the joint.

Possibly a small amount of benefit is thus accomplished by the shear keys but certainly not more than a small amount. The wooden plugs which form shear keys are usually made with beveled sides sawn smooth so that the plugs can be easily removed after the concrete has hardened. Evidently the "keyholes" thus formed, have but slight ability to retain the keys.

There is the further question of the condition of the concrete in the vicinity of the shear keys. For a short distance at the neutral axis the concrete undoubtedly is intact and capable of resisting tension. But beyond that plane or zone, both the general assumption and observation agree that the concrete is so cracked as to be incapable of resisting tension. What good then can shear keys in this region possibly do, when there is nothing beyond them to hold back either the keys or the "keyholes," even if the keys and "keyholes" function as Mr. Schwartz states?

Actually, the "exposure to the elements" at ordinary narrow or fine tension cracks or construction joints in reinforced concrete is, to say the least, highly hypothetical. If there were anything really serious about such "exposure," the practice of building concrete bridges would have been abandoned many years ago, for reinforced concrete will crack on the tension side, and concrete bridges are full of such cracks and joints. Well, what of it? A look at bridges 30 or 40 years old will give the only intelligent answer, which is, "There's no harm in tension cracks or construction joints. They don't break down. They don't cause deterioration."

The writer makes this statement knowing full well that there are bridges with badly rusted reinforcement and much concrete gone on the tension side of the beams, but he also knows that far more than tension cracks or construction joints are responsible for such conditions. He also knows from looking at many old concrete bridges possessed of both cracks and construction joints that they are substantially as good today as they were when first built.

Therefore to the writer shear keys on vertical construction joints appear to be a wholly ineffective means of accomplishing a needless objective.

HOMER M. HADLEY, M. ASCE
Consulting Engineer
Seattle, Wash.

Monies from Reclamation Projects Go Into Treasury Funds

TO THE EDITOR: This is in further comment on the discussion of reclamation financing started by Past President J. C. Stevens in his letter to the editor in the October 1952 issue and continued in the March 1953 issue by Lynn Crandall and Donald W. Van Tuyl. I am sure that many readers will be interested in a clarification of this subject of reclamation financing and repayment.

Except for the Boulder Canyon Project (Hoover Dam and Power Plant), monies received from the reclamation projects in the form of revenues from the sale of power and from repayment of construction costs by the water users on irrigated land are deposited in the Reclamation Fund. Also deposited in the Fund is a portion of the receipts from the sale of public lands, oil royalties, and other products of the public domain.

The Reclamation Fund is a separate account on the books of the U.S. Treasury, where a record is maintained of these receipts and collections. Actually, the cash that comes into the Treasury is not locked up in a separate vault with the reservation that it may only be used for the reclamation program. This income is comingled with all other income to the Treasury, and becomes part of the general finances of the Treasury. These monies do return to the

taxpayers, because the reclamation receipts are available to the Treasury to the same extent they would be if they were deposited directly to the so-called "Miscellaneous Funds" in the Treasury.

Congress controls both the authorization and the appropriation of funds for reclamation projects. Projects may be authorized by a specific act of Congress or found feasible by the Secretary of the Interior under the provisions of the Reclamation Project Act of 1939, but his finding must be implemented by appropriations from the Congress to become effective. Refusal of the Congress to appropriate funds suspends any Secretarial authorization made under the terms of the 1939 Act.

The Reclamation Fund is not a revolving fund. No expeditures may be made from funds credited to the Reclamation Fund except by direct appropriation of the Congress. The Fund was originally authorized in 1902 at the time Congress initiated the federal reclamation program. In the beginning the Secretary could make allotments from the fund without reference to the Congress but this authority was withdrawn in 1914 and beginning with the fiscal year 1915, Congress has appropriated all amounts expended by the Bureau of Reclamation except for some minor amounts advanced by water users for operation and maintenance of completed projects, or by states to match investigation allotments.

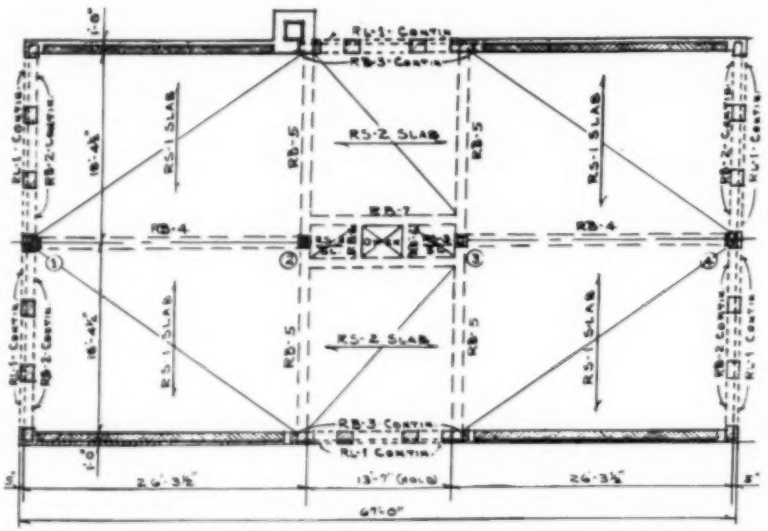
In recent years the annual programs of the Bureau for construction have exceeded the amounts available in the Fund, and Congress has appropriated the difference from the General Funds of the Treasury. The Bureau of Reclamation's annual budgets are reviewed by the Bureau of the Budget and the Congress and the funds are appropriated by the Congress in exactly the same manner as are funds for all other government agencies. The Bureau's fiscal activities are subject to all regulations, limitations, rules and Comptroller General's decisions that govern all federal agencies.

As an example of Congressional control, for the past three fiscal years the House Appropriations Committee has devoted over 500 pages of the Interior Department Hearings to reviewing the reclamation work, which is about 30 percent of the total time devoted to review of the entire Interior Department. In the Senate over 200 pages are devoted to review of the reclamation work, indicating that about 15 percent of the Senate's time has been devoted to reclamation. Not on record are the many hours spent by Bureau of Reclamation engineers and administrators with representatives of the Bureau of the Budget and the General Accounting Office examining in detail all the different facets of the Bureau's operations.

ALFRED R. GOLZÉ, M. ASCE
Director of Programs and Finance
U.S. Bureau of Reclamation

Washington, D.C.

Structural Drawings Should Clearly Indicate Framing Plan



Simple framing plan for roof of school building illustrates use of broken lines for spandrel and floor beams and for lintels, and single diagonal lines for slabs, with arrows pointing in direction of the steel. Pochading indicates vertical supports.

TO THE EDITOR: Structural drawings are sometimes criticized for lack of clarity and comprehensiveness. It is hoped that the following recommendations, based on nearly thirty years of experience in structural design and the preparation of structural drawings, will help to make such drawings more informative and to clear up some widely held misconceptions regarding their preparation.

A structural drawing is not a horizontal section taken at any particular elevation in a building. Rather it is a framing plan. Therefore it should show all the structural units that support or contribute to the support of the floor or roof level in question. This means that it should include all the supports that are in the story immediately below.

It will be difficult if not impossible for the engineer to determine the proper framing procedure for any area without first having a complete drawing of all vertical supports. The dimensions, positions and kinds of materials of the supporting members are all of primary importance. Pochade—the representation of timber, concrete, and other materials by means of drafting symbols—should be employed to designate the nature of the materials to be provided. If these vertical supports are in clear view, the engineer can quickly determine whether they are adequate in size, location and material—which would be much more difficult if they were on another plan or sheet.

All vertical supports (columns, piers or walls) should be shown by solid lines, with pochading to indicate character of materials. All openings requiring lintels should be clearly indicated by broken lines and by the omission of the pochading. All beams and girders are also shown by broken lines. Slabs are indicated by single diagonal lines between beams or other limits, using two-headed arrows to point in the direction of the steel. Openings through slabs should be indicated by solid lines with single crossing diagonal lines in the openings.

All lintels that may be poured as part of, or integrally with, the slabs of the framing plan level, as well as all lintels contributing to the support of loads at the level of the framing plan, should be shown as part of the framing plan—in broken lines.

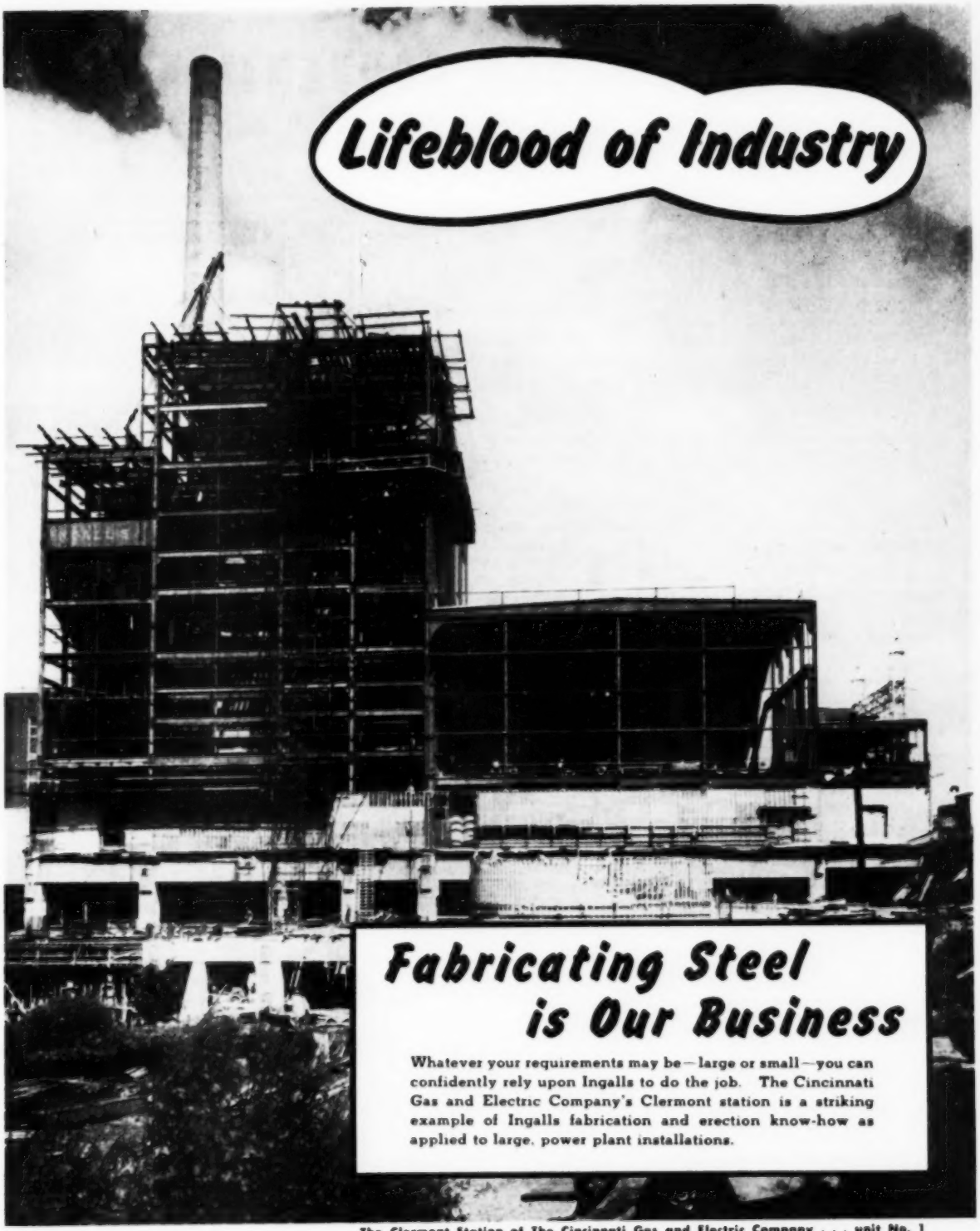
In the case of buildings having curtain walls supported on spandrel beams, the beams support parts of the floor slabs as well as the walls and are poured with the slabs. These spandrel beams, as well as the other floor beams, should be shown in broken lines. The bearing walls of the story below the framing plan (which support parts of the slabs, beams, etc.) should be shown in solid lines and pochade so as to differentiate them from the horizontal supports.

Walls, columns, lintels, beams, and such, which are above the framing plan, have no immediate function so should not be shown on the framing plan.

All columns should of course be marked in a regular sequence or by coordinates. All beams and girders should be marked in sequence and in such manner as to indicate the first, second, etc., floor or the roof. Slabs should be similarly designated. Schedules of slabs, beams, etc., should be shown on the same framing plan as the slabs and beams in question.

JOHN G. LOEHLER, M. ASCE
Consulting Engineer

Washington, D.C.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Fabricating Steel
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MIAMI BEACH CONVENTION

SPONSORED BY THE MIAMI SECTION

Casablanca Hotel, Miami Beach, Fla., June 16–19, 1953

REGISTRATION

CASABLANCA HOTEL. Main Lobby.

Hours: Monday, June 15, through Thursday, June 18, 9:00 a.m. to 5:00 p.m.; Friday, June 19, 9:00 a.m. to 12 noon.

Registration fee, except for ladies and students, $5.00.

LOCAL SECTIONS CONFERENCE

Monday, June 15 **9:30 a.m.**
Tuesday, June 16 **CASABLANCA HOTEL**

Representatives of Local Sections of ASCE in the South, Southeast, Caribbean, Central and South American areas will convene to discuss the expanding activities of ASCE at the Local Section level. The Conference, which is primarily for invited delegates of selected Sections, will be open to any and all who may be interested in the activities and operational details of Local Sections.

AUTHORS' BREAKFASTS

Tuesday–Friday **8:15 a.m.**
June 16–19

TERRACE
CASABLANCA HOTEL

Presiding: Lynn Perry, Chairman, Technical Program Committee

Briefing sessions for all speakers, and program officials by invitation.

TUESDAY MORNING AND AFTERNOON JUNE 16

Engineering Mechanics Division

ALGERIAN ROOM
CASABLANCA HOTEL

Morning Session

Presiding: Ralph E. Fadum, Member, Executive Committee, Engineering Mechanics Division

9:30 Photoelastic Analogy for Stress Determination in Certain Non-Homogeneous Elastic Foundations
A. J. CURTIS and F. E. RICHART, JR., A.M. ASCE, Assoc. Professor of Civil Engineering, University of Florida.

10:10 Experimental Analysis
DAN H. PLETTA, M. ASCE, Head of Applied Mechanics, Virginia Polytechnic Institute; DANIEL FREDERICK, J.M. ASCE, Research Assoc., Professor of Applied Mechanics, Virginia Polytechnic Institute.

10:50 Recent Developments in Three-Dimensional Photoelasticity
M. W. FROCHT, Illinois Institute of Technology, Chicago, Ill.

11:30 Bending Deflections of Constrained Circular Beam Resting on Elastic Foundation
ENRICO VOLTERRA, Professor of Mechanics, Rensselaer Polytechnic Institute; R. CHUNG, graduate student, Illinois Institute of Technology.

Afternoon Session

Presiding: Ralph E. Fadum, Member, Executive Committee, Engineering Mechanics Division

2:00 Applications of the Relaxation Method in Fluid Mechanics
JOHN S. McNOWN, M. ASCE, Assoc. Director, Iowa Institute of Hydr. Research, University of Iowa; CHIA-SHUN YIH and EN-YUN HSU, A.M. ASCE; Resident Engineers, Hydrodynamics Lab., California Institute of Technology.

2:40 Stress–Deformation Analysis by Numerical Methods
E. D'APPOLONIA, A.M. ASCE, Professor, Carnegie Institute of Technology; C. E. MILLER, JR., Constr. Project Engineer, International Minerals & Chemical Corp., Chicago; T. M. WARE, Vice President, Engineering Div., International Minerals & Chemical Corp., Chicago., Ill.

3:20 Application of Heaviside's Step-Function to Beam Problems
JOHN E. GOLDBERG, M. ASCE, Assoc. Professor of Structural Engineering, Purdue University.

4:00 Application of Power Series Transform to Linear Difference Equations in Engineering
LEONARD McFADDEN, Dept. of Mathematics, V. P. I., Blacksburg, Va.

WEDNESDAY MORNING JUNE 17

Construction Division

ALGERIAN ROOM
CASABLANCA HOTEL

Presiding: Warren N. Riker, Chairman, Program Committee, Construction Division

Almendares Tunnel, Havana, Cuba—Construction Planning and Operations

9:30 Planned Construction for Unusual Subsurface Conditions
H. C. BOSCHEN, M. ASCE, Vice President, Raymond Concrete Pile Co., New York, N.Y.

9:45 Intrusion Grouting of Porous Foundation Permits Dewatering Open Cofferdam in River
JOHN C. KING, A.M. ASCE, Chief Engineer, and JOHN R. ANDERSON, Foundation Engineer, Intrusion-Prepakt, Inc., Cleveland, Ohio.

10:00 Unwatering Problems
BYRON C. PRUGH, A.M. ASCE, Moretrench Corp., New York, N.Y.

Elizabeth River Tunnel, Norfolk, Va.

10:45 Design Criteria
JOHN O. BICKEL, M. ASCE, Principal Associate and Engineering Manager, Parsons, Brinckerhoff, Hall & Macdonald, New York, N.Y.

11:15 Construction
JOSEPH PERIANO, Division Chief Engineer, Merritt, Chapman & Scott, New York, N.Y.

Discussions

11:45 Almendares Tunnel

12:00 Elizabeth River Tunnel

Highway Division

CARD ROOM
CASABLANCA HOTEL

Presiding: Harold J. McKeever, Member, Executive Committee, Highway Division

9:30 Planning and Operating Turnpikes
CHARLES M. NOBLE, M. ASCE, Chief Engineer, New Jersey Turnpike Authority

10:00 Florida Turnpike
CURTIS J. HOOPER, M. ASCE, Assoc. Engineer, Parsons, Brinckerhoff, Hall & Macdonald, New York, N.Y.

10:30 Program for Highway Development in Iraq
GUY KELCEY, M. ASCE, Edwards, Kelcey & Beck, Consulting Engineers, New York, N.Y.

11:00 Innovations in Primary Road Program in Delaware
RICHARD A. HABER, A.M. ASCE, Chief Engineer, Delaware State Highway Commission.

Hydraulics Division

CONVENTION ROOM
CASABLANCA HOTEL

Presiding: Carl E. Kindsvater, Chairman, Committee on Research, Hydraulics Division

9:30 Laboratory Experiments on Growth of Waves in Shallow Water
GARBIS H. KEULEGAN, Physicist, National Bureau of Standards, Washington, D.C.

10:00 Effect of Wave Damping on Selection of Scale for Harbor Models
GEORGE F. DIXON, J.M. ASCE, District Engineer, U.S. Corps of Engineers, Vicksburg, Miss.

10:30 Forecasting Waves on Atlantic Coast
J. M. CALDWELL, A.M. ASCE, Beach Erosion Board, Washington, D.C.

11:00 Lake Okeechobee Wind Set-Up Investigations
JOHN H. KLINCK, JR., A.M. ASCE, Hydraulic Engineer, Jacksonville District, U.S. Corps of Engineers, Jacksonville, Fla.

Soil Mechanics and Foundations Division

CARD ROOM
MARTINIQUE HOTEL

Presiding: W. J. Turnbull, Member, Executive Committee, Soil Mechanics and Foundations Division

9:30 Sand Compaction by Vibroflotation
E. D'APPOLONIA, A.M. ASCE, Professor, Carnegie Institute of Technology; C. E. MILLER, JR., Construction Project Engineer, International Minerals & Chemical Corp. Chicago; T. M. WARE, Vice President, Engineering Division, International Minerals & Chemical Corp., Chicago, Ill.

10:15 Changing of Subgrade Strengths Under Traffic
CHARLES R. FOSTER, A.M. ASCE, Waterways Experiment Station, Corps of Engineer, Vicksburg, Miss.

11:00 Local Tests on Soils in Miami Area
J. CALVIN JURBIT, J.M. ASCE; Wingarter Laboratories, Inc., Miami, Fla.

WELCOMING LUNCHEON

Wednesday, June 17 12:15 p.m.

MOROCCO ROOM
CASABLANCA HOTEL

Presiding: Edmund Friedman, Vice President, ASCE

Welcome by Miami Section
HENRY H. HYMAN, President, Miami Section.

Welcome by City of Miami Beach
D. LEE POWELL, Mayor.

Welcome by City of Miami
CHELSIE J. SENERCHIA, Mayor.

Response
WALTER L. HUBER, President, ASCE.

All members, their ladies and guests, and friends of ASCE are cordially invited to attend this luncheon.

Price, $3.00 per plate.

WEDNESDAY AFTERNOON
JUNE 17

Construction Division

ALGERIAN ROOM
CASABLANCA HOTEL

Presiding: Warren N. Riker, Chairman, Program Committee, Construction Division

Industrial Development of South

2:00 Industrial Growth of South
A. G. STANFORD, Vice President, Robert & Co., Atlanta, Ga.

2:45 Development of Pulp and Paper Industry
A. G. WAKEMAN, Vice President, Coosa River Newsprint Co., Coosa Pines, Ala.

3:00 Development of Chemical Industry
C. O. HOVER, Chief Engineer, Chemstand Corp., Decatur, Ala.

4:15 Discussion

Hydraulics Division

CONVENTION ROOM
CASABLANA HOTEL

Presiding: J. B. Tiffany, Member, Executive Committee, Hydraulics Division

2:00 Canaveral Harbor Inlet Project
COL. HERMAN W. SCHULL, District Engineer, Jacksonville District, Corps of Engineers, Jacksonville, Fla.

2:45 Salt Water Encroachment into Well Water in Miami Area
E. M. RADER, M. ASCE, Rader Engineering Co., Miami, Fla.

3:30 By-Passing Littoral Drift at Coastal Inlet
R. O. EATON, M. ASCE, and GEORGE M. WATTS, J.M. ASCE; Beach Erosion Board, Washington, D.C.

Air Transport Division

CARD ROOM
CASABLANCA HOTEL

Presiding: Earle M. Rader, Miami Beach Convention Committee, Air Transport Division

2:00 Airport Financing
A. B. CURRY, Director, Miami International Airport, Miami, Fla.

2:45 Airports and Aviation in Latin America
KENNETH E. CALENDER, Rader Engineering Co., Miami, Fla.

3:30 Paving Design for Jet Planes
JOHN G. RAKOWSKY, Civil Engineer, Rader Engineering Co., Miami, Fla.

Soil Mechanics and Foundations Division

CARD ROOM
MARTINIQUE HOTEL

Presiding: W. J. Turnbull, Member, Executive Committee, Soil Mechanics and Foundations Division

2:00 Soil Mechanics Work, Jim Woodruff Dam
J. W. POLATTY, Mobile District Corps of Engineers, Mobile, Ala.

2:45 Unusual Foundation Problems Encountered on Central and Southern Florida Flood-Control Project
PAUL H. SHEA, Geologist and Soils Engineer, Jacksonville District, Corps of Engineers, Jacksonville, Fla.

3:30 Studies of Settlement and Seepage at Clark Hill Dam During and After Construction
FRANK M. BELL, A.M. ASCE, Chief, Soils Mechanics Branch, Corps of Engineers, Marietta, Ga.

COCKTAIL PARTY AND AQUACADE

Wednesday, June 17 **5:45 to 8:00 p.m.**

POOL AND CABANA AREA
CASABLANCA HOTEL

An entire evening of entertainment and sociability. All those registered at the Convention, and their families, are cordially invited.

THURSDAY MORNING
JUNE 18

City Planning Division

CARD ROOM
MARTINIQUE HOTEL

Presiding: Lawrence V. Sheridan, Member, Executive Committee, City Planning Division

9:30 City Planning in Miami Region
M. B. GARRIS, A.M. ASCE, Consulting Engineer, Miami; and WILLIAM J. KNOX, A.M. ASCE, Consulting Engineer, Hialeah Engineering Co., Miami, Fla.

10:10 Community and Neighborhood Development
DONALD W. MCGLASHON, M. ASCE, Chief Engineer, Harland, Bartholomew & Assocs., St. Louis, Mo.

10:50 Economic Value of Good City Planning
GEORGE W. SIMONS, JR., M. ASCE, Planning Consultant, Jacksonville, Fla.

11:30 Discussion
FRED BAIR, Florida State Improvement Commission, Tallahassee, Fla.; and F. D. R. PARK, M. ASCE, Dade County, Fla., Engineering Dept.

Structural Division

CONVENTION ROOM
CASABLANCA HOTEL

Presiding: R. H. Sherlock, Chairman, Committee on Wind Forces, Structural Division

9:30 Wind Velocities During Hurricanes
ROBERT C. GENTRY, Meteorologist, Weather Bureau, Miami, Fla.

10:10 Effects on Structures of Winds of Hurricane Force
HERBERT S. SAFFIR, M. ASCE, Asst. County Engineer, Miami, Fla.

10:50 Frequency of Return of Maximum Wind Velocities
H. C. S. THOM, Chief Climatologist, U.S. Weather Bureau.

11:30 Wind Loads on Truss Bridges
JOHN M. BIGGS, A.M. ASCE, Asst. Professor of Structural Engineering, Massachusetts Institute of Technology.

Air Transport Division

CARD ROOM
CASABLANCA HOTEL

Presiding: Earle M. Rader, Miami Beach Convention Committee, Air Transport Division

9:30 Development of Miami International Airport
EARLE M. RADER, M. ASCE, Consulting Engineer, Miami, Fla.

10:15 Engineering and Economic Problems Involved in Airport Location
ROBERT N. COOK, Manager, Washington Office, Rader Engineering Co., Miami, Fla.

11:00 Docking Facilities for Jet Aircraft
J. W. CURRY, Rader Engineering Co., Miami, Fla.

11:45 Discussion

Sanitary Engineering Division

ALGERIAN ROOM
CASABLANCA HOTEL

Presiding: Ralph E. Fuhrman, Member, Executive Committee, Sanitary Engineering Division

9:00 Miami Sewage Disposal Program
E. SHERMAN CHASE, M. ASCE, Partner, Metcalf & Eddy, Boston, Mass.

10:00 Performance of Biofiltration Plants
R. S. RANKIN, M. ASCE, Manager, Sanitary Engineering Division, The Dorr Co., Stamford, Mass.

11:00 Control of Aquatic Growths by Copper Sulphate
RAY L. DERBY, M. ASCE, Principal Sanitary Engineer; and D. W. GRAHAM, Sanitary Engineer, Dept. of Water & Power, Los Angeles, Calif.

MEMBERSHIP LUNCHEON

Thursday, June 18 **12:15 p.m.**

MOROCCO ROOM
CASABLANCA HOTEL

RICHARD B. ROBERTS, Economic Research Director and Vice President, Florida Power and Light Company, will speak. His subject will be, "Development of South Florida."

All members, their ladies and guests and friends of ASCE are cordially invited to attend.

Price, $3.00 per person.

THURSDAY AFTERNOON
JUNE 18

Structural Division

CONVENTION ROOM
CASABLANCA HOTEL

Presiding: E. C. Hartmann, Member, Executive Committee, Structural Division

2:00 Measurement of Dead Load Stresses in Mississippi River Bridge at E. St. Louis, Ill.
R. W. KLUGE, A.M. ASCE, Head, Dept. of Civil Engineering, University of Florida; M. B. LAGAARD, M. ASCE, Assoc. Professor, Civil Engineering, Northwestern University; E. W. LARSEN, JR., J.M. ASCE, Research Assoc., Purdue University; K. H. LENZEN, J.M. ASCE, Dept. of Structural Engineering, Purdue University; LEWIS B. MCCAMMON, A.M. ASCE, C. F. Braun & Co., Alhambra, Calif.; L. T. WYLY, M. ASCE, Head, Structural Engineering, Purdue University.

2:40 John E. Mathews Bridge, Jacksonville, Fla.
M. N. QUADE, M. ASCE, and RICHARD LEE, A.M. ASCE; Parsons, Brinckerhoff, Hall & Macdonald, New York, N.Y.

3:20 Gilmore Street Bridge, Jacksonville, Fla.
P. M. HUDDLESTON, A.M. ASCE, Reynolds, Smith & Hills, Jacksonville, Fla.

4:00 Design of Monolithic Concrete Frame—Prestressed
K. P. MILBRADT, Asst. Professor, Dept. of Civil Engineering, Illinois Institute of Technology; T. J. KOPODIMOS, Structural Engineer.

Irrigation and Drainage Division

CARD ROOM
CASABLANCA HOTEL

Presiding: George S. Knapp, Chairman, Executive Committee, Irrigation and Drainage Division

2:00 Water Control in Central and Southern Florida
HAROLD A. SCOTT, M. ASCE, Chief, Planning and Reports Branch, Corps of Engineers, Jacksonville, Fla.

2:40 Hydraulic Problems of Local Interests in Central and Southern Florida
HERBERT C. GEE, M. ASCE, President, Gee & Jensen, Inc., West Palm Beach, Fla.

3:20 Central and Southern Florida Project—Design Rainfall
L. A. FARRER, A.M. ASCE, Chief, Meteorology and Regulation Sec-

tion, Corps of Engineers, Jacksonville, Fla.

4:00 Water Control—Central and Southern Florida Project—Hydrology Characteristics

ANGELO TABITA, A.M. ASCE, Chief, Hydrology Section, Corps of Engineers, Jacksonville, Fla.

Sanitary Engineering Division

ALGERIAN ROOM
CASABLANCA HOTEL

Presiding: William W. Aultman, Chairman, Miami Beach Convention, Sanitary Engineering Division

2:00 Current Research in Sanitary Engineering at University of Florida

DAVID B. SMITH, A.M. ASCE Assoc. Professor of Civil Engineering, University of Florida.

2:45 Water Pollution Control Policy

PAUL D. HANEY, M. ASCE, Sanitary Engineer, U.S. Public Health Service, Cincinnati, Ohio.

3:30 Economic Aspects of Sanitary Engineering and Sanitation

THOMAS DES. FURMAN, Asst. Professor of Civil Engineering, University of Florida.

DINNER AND DANCE

Thursday, June 18

MOROCCO ROOM
CASABLANCA HOTEL

7:30 p.m. Dinner

9:30 p.m. Dancing and entertainment

The seating capacity is 600 persons. Reservations will be accepted in order received. Dress informal.

Price, $7.50 per person.

FRIDAY MORNING

JUNE 19

Surveying and Mapping Division

CONVENTION ROOM
CASABLANCA HOTEL

Presiding: Henry B. Aiken, Chairman, Executive Committee, Surveying and Mapping Division

9:30 Modern Military Grid System

FLOYD W. HOUGH, M. ASCE, Chief Geodetic Division, Army Map Service, Washington, D.C.

10:00 Topographic Mapping by U.S.G.S. in Florida

DANIEL KENNEDY, M. ASCE, Central Region Engineer, Topographic Division, U.S.G.S., Rolla, Mo.

10:30 First Map of Caloosahatchee-Everglades Area

JON S. BEAZLEY, A.M. ASCE, Photogrammetric Engineer, Tallahassee, Fla.

11:00 Surveying in Florida Everglades

KEITH M. HARTSFIELD, Chief of Survey Branch, U.S. Corps of Engineers, Jacksonville, Fla.

11:30 Photogrammetry—Its Advantages, Uses and Limitations

GEORGE D. HARDY, Photogrammetric Engineer, Michael Baker, Jr., Inc., Jackson, Miss.

Irrigation and Drainage Division

CARD ROOM
CASABLANCA HOTEL

Presiding: George S. Knapp, Chairman, Executive Committee, Irrigation and Drainage Division

9:30 Economic Analysis for Justification of Works

N. HIGGINSON, Chief, Canals Unit, Corps of Engineers, Jacksonville, Fla.

10:10 Hydraulic Design of Pump Station 5A

EDWIN W. EDEN, JR., M. ASCE, Chief, Hydraulic Design Section, Corps of Engineers, Jacksonville, Fla.

10:50 Selection of Pumps and Design of High-Volume Low-Head Pumping Station

GEORGE F. SNODGRASS, Chief, Design Branch, Corps of Engineers, Jacksonville, Fla.

Sanitary Engineering Division

ALGERIAN ROOM
CASABLANCA HOTEL

Presiding: Lynn Perry, Chairman, Technical Program, Miami Beach Convention

Symposium—Water Supply for Florida Keys

9:00 Key West Aqueduct

PETER CORRADI, M. ASCE, Bureau of Yards and Docks, USN, Washington, D.C.; BURR LENHART, Head, Water Supply Section, Bureau of Yards and Docks, USN.

10:00 Design of Recent Additions to Key West Aqueduct

WALTER J. PARKS, JR., A.M. ASCE, Sanitary Engineer, Reynolds, Smith and Hills, Jacksonville, Fla.

11:00 New Florida Keys Aqueduct

JOHN W. GREENLEAF, JR., M. ASCE, Partner, Rader Engineering Co., Miami, Fla.

CONVENTION LUNCHEON

Friday, June 19 **12:15 p.m.**

MOROCCO ROOM
CASABLANCA HOTEL

All members, their ladies and guests, and friends of ASCE are cordially invited to attend.

Price, $3.00.

LADIES' ENTERTAINMENT

Ladies' Headquarters:
HOSPITALITY ROOM
CASABLANCA HOTEL

Hospitality Room will be the starting point of all events. It will be open from 9:00 a.m. to 5:00 p.m., Monday through Friday. Hostesses will be in attendance to serve coffee and tea, arrange for card and beach parties, and answer questions.

Tuesday, June 16

Afternoon

1:00 Open air tea at home of Mr. and Mrs. Sussman, followed by shopping tour of Lincoln Road (The Fifth Avenue of the South), Miami Beach.

Wednesday, June 17

Morning

9:30 Coffee Hour, Hospitality Room

12:15 Welcoming Luncheon, Morocco Room, Casablanca Hotel, very informal

Afternoon

2:30 to 5:00 Boat trip around the beautiful islands in Biscayne Bay. 30 miles of inland waterway—no ocean travel. Beautiful sights, homes, monuments, etc.

Price, $2.75 per person, plus taxi fare.

5:45 Cocktail Party and Aquacade
Pool and Cabana area
Casablanca Hotel

Thursday, June 18

Morning

9:30 Coffee Hour, Hospitality Room

10:30 Bathing in pool or ocean

Afternoon

1:00 Sightseeing tour (glass-top buses) through Miami Beach, Miami, Coral Gables, etc., including stops at Lowe Gallery of Art, University of Miami, and the Parrot Jungle.

Price, $3.00.

7:30 Dinner Dance
Morocco Room, Casablanca Hotel

Friday, June 19

Morning

9:30 Coffee Hour, Hospitality Room, Casablanca Hotel. Remainder of day free for bathing, shopping, etc. Women are urged to participate in planned tours.

FRIDAY AFTERNOON

JUNE 19

PLANNED TOURS

Buses or private cars will leave front entrance of Casablanca Hotel at time scheduled below. Ladies welcome.

Tour No. 1

1:30 p.m.

Miami International Airport

Largest engine overhaul shop in the world. Overhaul base employs a total of 17,000 people. The largest and newest nose hangar in the world, and other features of airport, which handles 47 per cent of all traffic from points outside continental United States.

Price, $2.00.

Tour No. 2

1:15 p.m.

Southwest Water Treatment Plant, City of Miami

Forty-mgd plant with ultimate capacity of 100 mgd, now under construction. Also, University of Miami main campus.

Price, $2.00.

Tour No. 3

1:15 p.m.

Central and South Florida Flood Control Project

Dykes and control structures near Route 27, northwest of Miami, including sluice gate and Tainter gate controls. Pumping station under construction on Route 27.

Price, $2.00.

PRESS ROOM

CASABLANCA HOTEL

For the convenience of the technical press, newspapers and radio, a press room will be open throughout the days of the Convention. Members of the Publicity Committee will be on hand to provide information.

CONVENTION PAPERS AVAILABLE

For the convenience of members attending the Convention, the papers presented have been duplicated whenever they were available early enough for this purpose. These copies can be obtained on the Convention floor throughout the days of the Convention. After the Convention, they can be ordered as PROCEEDINGS SEPARATES from ASCE Headquarters in New York, using coupon clipped from CIVIL ENGINEERING.

Price, 25 cents a copy.

POST CONVENTION TOUR

HAVANA, CUBA

Friday, June 19

Evening

6:00 Leave Miami dock by boat
Dinner on board, dancing and games during evening

Saturday, June 20

Morning

Breakfast on board

8:00 Debark at Havana

Afternoon

1:30 City tour

9:30 Dinner and Floor Show
Monmart Night Club

Sunday, June 21

Morning

10:00 Country tour. Lunch at model farm, final stop at Bacardi Distillery for inspection and cocktails

Evening

Board boat

Dinner on board

Monday, June 22

Morning

Breakfast on board

8:00 Arrive Miami

Price, $85.50 per person, plus federal tax of $7.35, total of $92.85.

An alternate tour may be made by plane leaving Friday evening, spending that night in Havana and joining regular tour Saturday morning. Return Sunday night.

Price, same as above.

Note: All reservation requests and inquiries for this post convention tour, should be addressed directly to:

MR. C. E. PETT
Casablanca Hotel
Miami Beach 40, Fla.

EDUCATORS COORDINATE GAINESVILLE MEETING

The American Society for Engineering Education has scheduled its Annual Meeting for June 22-26, the week following this ASCE Convention, to be held in Gainesville, Fla., on the grounds of the University of Florida. Objective of this cooperative effort is to facilitate attendance of those active in both organizations.

A full program for the ASEE Annual Meeting will be published by that Society. Detailed information may be obtained directly from:

DR. ARTHUR B. BRONWELL
Secretary
American Society of Engineering Education
Northwestern University
Evanston, Ill.

HOTEL RESERVATIONS

All requests should be addressed to:

MR. WM. C. GORMAN
Chairman, Hotel Committee
Casablanca Hotel
Miami Beach 40, Fla.

Since all requests for room will be handled chronologically, it is recommended that you send in your reservation as quickly as possible. The Casablanca Hotel will be the Convention Headquarters but rooms will be available at two adjacent hotels, the Martinique and the Coronet.

In making hotel reservations, please use the blank on page 82. While the rates in all three hotels are the same, you are requested to indicate your first, second and third choice.

CONVENTION COMMITTEES

C. F. WERTZ, *General Chairman*

General Convention Committee

Warren Brockway — H. H. Hyman
Edmund Friedman — Carl Lindholm
J. W. Greenleaf, Jr. — Morris Lipp
Robert Hart — Claude Renshaw

Entertainment
H. J. MORRISON, *Chairman*

Excursions
GEO. E. WATSON, *Chairman*

Finance
W. J. KNOX, *Chairman*

Hotels and Registration
WM. C. GORMAN, *Chairman*

Ladies' Activities
MRS. WM. C. GORMAN, MRS. E. J. REEDER — *Co-Chairmen*

Local Sections' Cooperation
E. J. REEDER, *Chairman*

Publicity
L. S. EDWARDS, WM. SUSSMAN — *Co-Chairmen*

Reception
T. J. CLARKE, *Chairman*

Student Activities
MURRAY I. MANTELL, *Chairman*

Technical Program
COL. LYNN PERRY, *Chairman*
C. I. Babcock — Leroy S. Edwards
S. C. Dunlop — E. H. Magoon

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SOCIETY NEWS

Register Now for Miami Beach Convention

A large cabana area, Olympic-sized swimming pool, and every imaginable facility for fun and recreation will be at the disposal of ASCE members and guests stopping at the Casablanca, official headquarters hotel for the ASCE Miami Beach Convention, June 17–19. In addition to the varied technical program with papers, panel discussions, and inspection trips for every professional interest (see the official program, page 56), the Miami Beach Convention offers all the resources for relaxation and enjoyment of a time-tried resort city.

President Huber Addresses Mid-South Section Meeting

Engineering projects in the Little Rock area were featured on the program of the Mid-South Section's spring meeting at Little Rock, April 9–11. Also on the agenda were a meeting of the ASCE Executive Committee and an inspiring address by President Walter L. Huber on "What the American Society of Civil Engineers Means to Me." President Huber said in part: "The Society has been a beacon to me throughout my career. To me it is a living thing—not merely an assemblage of by-laws, reports and administrative matters, nor is it merely a forum for the delivery of technical papers, although its contribution in this respect has been outstanding. Through it have come some of my finest friendships—often with those who have given inspiration and leadership. The question now so often heard, 'What will the Society do for me?' never occurred to me, but it did much. Through it I learned of the various approaches to problems and their solution; I learned the importance of the human equation; I learned much that could not be acquired through textbooks; and I gained a broadened vision of the profession to which I was to devote my life."

Meeting in Little Rock, Ark., the Board of Directors of the Mid-South Section stops work long enough to be photographed. Shown, in usual order, are F. A. Busse (standing); Past-President K. W. Lefever; A. W. Hardy, president, Little Rock Branch; ASCE Director Norman R. Moore; J. R. Newman (standing), president, Memphis Branch; Secretary-Treasurer E. C. Meserve; Section President E. F. Bespalow; B. H. Biggers, president, Jackson Branch; Vice-President R. W. Sauer; and E. L. Chandler, Assistant Secretary of ASCE. Messrs. Moore and Chandler were guests at the board meeting. Absent when photo was taken were Directors F. T. Quinn, A. E. Johnson, J. H. Teunisson, Jr., J. R. Bissett, and Vicksburg Branch President D. O. Coe. Photo courtesy of "Construction News Monthly."

Noting that one of the serious problems now facing the nation is the shortage of trained engineering personnel, President Huber said, "To me it is inconceivable that it should be necessary to recruit young talent by pointing out some of the factors that make the profession of civil engineering so interesting and so satisfying to its devotees. How deadly to work at something which is found to be uninteresting! This need never be the lot of the civil engineer if he has any imagination.

"The initial inspiration of the next generation of engineers," he said, "should come from our engineering educators. A special burden rests upon them. . . . Our faculties should include both capable scientists and engineers with broad viewpoint encompassing the demands of the profession. Remuneration to attract these men in competition with the outside demands from an understaffed profession is not easily secured. Here the profession can and should help by offering its aid and its influence to the responsible heads of our universities."

Prior to delivering his address, the principal feature of the Friday night banquet, President Huber presented a

certificate of life membership to H. V. Pittman, who retired a year ago from the Little Rock District after 42 years with the Corps of Engineers. At the banquet the Section was host to the various ASCE committees assembled in Little Rock for the initial meeting of the newly organized Comittee on Conditions of Practice.

Local projects discussed included Table Rock Dam, the subject of a paper by C. M. Greer, of the Little Rock District of the Corps of Engineers, and the Fort Smith water supply, covered by W. R. Holway, Tulsa consultant. There was an inspection trip to Granite Mountain Quarry, where the group witnessed a demonstration of the "oxygen jet piercing method" of drilling hard rock.

Committee on Conditions of Practice Formed at Little Rock

Organization of an ASCE Committee on Conditions of Practice, an important new development in Society operation, was accomplished on April 12 at Little Rock, Ark., following the Mid-South Section's three-day spring meeting. The new overall committee for coordinating the Society's professional practice activities and interests will be similar in organization and operation to the Technical Procedure Committee—the Society's organization for coordinating technical activities. It will maintain general direction of the activities of the eight constituent committees and determine their budget requirements. It will meet once a year.

Committee members present at the Little Rock organization meeting were Vice-President A M Rawn, chairman; Vice-President G. Brooks Earnest, vice-chairman; Director Norman R. Moore, and Chairman John A. Focht, of the Committee on Local Sections; Director Wallace L. Chadwick and Chairman Archie N. Carter, of the Committee on Junior Members; Director James A. Higgs and Chairman Robert H. Dodds, of the Committee on Student Chapters; Chairman Weston S. Evans, Sr., of the Committee on Engineering Education; Director Charles B. Molineaux and Chairman Clarence L. Eckel, of the Committee on Registration of Engineers; Director Lloyd D. Knapp, of the Committee on Professional Practice; Director Warren W. Parks and Chairman Ray E. Lawrence, of the Committee on Salaries; and E. L. Chandler, as Secretary of the Committee.

Members absent were Director Francis M. Dawson, of the Committee on Engineering Education; Chairman Gustav J. Requardt, of the Committee on Professional Practice; Director I. Cleveland Steele and Chairman George I. Teufel, of the Committee on Employment Conditions. Others attending the meeting were President Walter L. Huber, Executive Secretary W. N. Carey, Leo C. Novak, George W. Bradshaw, C. D. Williams, and Gail A. Hathaway.

Mid-South Section President E. F. Bespalow (left in upper photo) receives the traditional key to the city from Pratt C. Remmel, mayor of Little Rock. ASCE Committee chairmen, in Little Rock for organization meeting of Committee on Professional Practice, are (lower view): A. N. Carter, Junior Members; R. H. Dodds, Student Chapters; and J. A. Focht, Local Sections. Photos courtesy of "Construction News Monthly."

M. C. Nichols to Head Bureau of Reclamation

Secretary of the Interior Douglas McKay has recommended to President Eisenhower the appointment of Marvin C. Nichols, M. ASCE, of Fort Worth, Tex., as Commissioner of the Bureau of Reclamation. A member of the Fort Worth consulting firm of Freese & Nichols and its predecessor firm, Hawley, Freese & Nichols since 1927, Mr. Nichols has specialized in municipal development and has been adviser to several Texas counties. He is a native of Roanoke, Va., and a graduate of the University of Texas, class of 1918.

The appointment, which does not require Senate confirmation, returns the post to an engineer.

William P. Creager and Gano Dunn, ASCE Honorary Members, Die

Death has taken two of the Society's most distinguished members—William P. Creager, Hon. M. ASCE, who passed away in Buffalo, N. Y., on April 4, at the age of 74, and Gano Dunn, Hon. M. ASCE, whose death occurred in New York City on April 10, at the age of 82.

William P. Creager

An internationally known authority on power plants and dams, Mr. Creager was in consulting practice in Buffalo from 1930 until his death. During this period he was consultant for more than 30 public utility corporations, involving designs for about 40 dams and 20 hydroelectric plants. Earlier (1906 to 1922) he was designer of dams and hydroelectric developments here and abroad for the J. G. White Corp., and from 1922 to 1930 he was vice-president and chief engineer of the Power Corporation of New York and the Northern New York Utilities.

Mr. Creager was a graduate of Rensselaer Polytechnic Institute, which gave him an honorary engineering doctorate in 1951. Long a member of ASCE and chairman of the executive committee of the Power Division, Mr. Creager was elected Honorary Member in 1949. He was author of widely used texts on dams

William P. Creager

and power—some of them written in collaboration with Julian Hinds and the late Joel D. Justin—and an extensive contributor to technical publications.

Gano Dunn

Eminent as an engineer, educator, and industrialist, Gano Dunn was president of the J. G. White Engineering Corp. from 1913 until his death. From 1935 until recently he was also president of Cooper Union and, at the time of his death, was chairman of the board. During his long tenure as president of the J. G. White Engineering Corp., it designed and built many hydraulic, steam power, chemical, and oil plants, including the U.S. Naval Oil Base at Pearl Harbor; the Muscle Shoals steam plant; thirteen transoceanic radio stations, the first government aviation station at Langley Field, Va.; the first long-distance, natural-gas pipeline in California; and three large irrigation dams for the Republic of Mexico.

An alumnus of the City College of New York with a graduate degree in electrical engineering from Columbia University, Mr. Dunn subsequently was awarded honorary degrees by a number of universities. He was instrumental in organizing the Engineering Foundation, which he served as first chairman, and for three years was president of the United Engineering Trustees. He was a past-president and honorary member of the American Institute of Electrical Engineers and honorary member of the American Society of Mechanical Engineers as well as an Honorary Member of ASCE (1948).

Gano Dunn

Metropolitan Section Selects Seven Engineering Wonders

. The foremost engineering "wonder" in the metropolitan area, by vote of the members of the Metropolitan Section, is the George Washington Bridge, spanning the Hudson River between 178th Street, Manhattan, and Fort Lee, N.J. Longest suspension bridge ever built at the time of its completion, and now second only to the Golden Gate Bridge in San Francisco, the George Washington Bridge was selected over 42 other projects for which ballots were cast.

Members of the Metropolitan Section had undertaken to select the achievements which, among the multitudinous distinguished works of the metropolitan area, constituted, in their opinion, the region's "Seven Wonders" from an engineering standpoint. The results of their voting are as follows: George Washington Bridge, 20 percent; Brooklyn Bridge, 14 percent; Empire State Building, 12 percent; New York City Subway System, 9 percent; New York Water Supply System, 7 percent; Holland Tunnel, 7 percent; and Brooklyn Battery Tunnel, 5 percent.

As runners-up, with a total of 14 percent, the civil engineers named the following "wonders," in this order of choice: United Nations Building, Rockefeller Center, Grand Central Terminal, Parks and Parkways, Docks and Piers, and the New Jersey Turnpike. The remaining 12 percent of the balloting was divided among 30 other projects.

The Metropolitan Section, of which William L. Hanavan is president, includes Greater New York, Long Island, Westchester County, Rockland County and Northern New Jersey.

In general, the tabulators noted the following reasons for their choice.

George Washington Bridge: Longest suspension span in the world at the time it was opened; magnitude; beauty; usefulness.

Brooklyn Bridge: The daring of its designers and builders in pioneering the way for the many long-span suspension bridges in use today.

Empire State Building: Impressive magnitude.

New York City Subway System: Longest, safest, and most heavily patronized urban underground railroad in the world.

New York Water Supply System: Magnitude; vital importance in bringing over one billion gallons of clean, safe water over long distances and difficult terrain into the homes of millions of people and to thousands of industrial plants.

Holland and Brooklyn Tunnels: Time-saving traffic arteries that connect with important highways; conquest of construction difficulties; excellent ventilating and lighting systems.

The "Seven Wonders" program of the Metropolitan Section was set in motion in 1952 during the Society's Centennial Year. Similar programs have been undertaken by many other Sections.

Empire State Building, symbol of the skyscraper era and the tallest structure in the world, rises 1,472 ft above Fifth Avenue.

FROM THE NATION'S CAPITAL

JOSEPH H. EHLERS, M. ASCE — Field Representative ASCE

Executive Department

Actions in the Executive Department were of significance and interest to the engineering profession during the past month: Creation of an entirely new department, abolishing of several old agencies and some controversial actions by department heads.

The new Department of Health, Education and Welfare, under its first Secretary, Mrs. Oveta Culp Hobby, is of great interest as many of our members are employees of its constituent agency, the Public Health Service. Loans and grants for sanitary engineering projects, as well as for school construction, are handled in this new department.

Two prominent ASCE members have begun their duties in positions of high responsibility—Ralph Tudor as Under Secretary of the Interior and Gen. Glen Edgerton as Chairman of the Board of the Export-Import Bank. A third, Marvin C. Nichols, has just been named Commissioner of the Bureau of Reclamation.

An Executive Department action that misfired was the attempted dismissal of the Director of the Bureau of Standards. Several issues were involved. First, in connection with findings on a battery additive, the basic question of the integrity of government science became involved and hundreds of scientists might have resigned from the Bureau. Abel Wolman, M. ASCE, has been designated by President Huber, at the request of the Department of Commerce, to serve on a committee to study the Bureau's functions. The District of Columbia Section of ASCE addressed a letter to the White House deploring the implications involved in the situation and urging a speedy investigation. Meanwhile, the director of the Bureau has been asked to continue pending such investigations.

As a secondary issue, the case also involved the abrupt handling of long-time Civil Service career employees. This issue has also cropped up in a few other cases. The entire Civil Service issue is of great importance. Certain agencies have been remarkably free of political influence and have abided by strict Civil Service standards. Among many others, the Bureau of Public Roads, under former Director Thomas H. MacDonald, Hon. M. ASCE, might be mentioned as a follower of strict standards. Where there has been political packing in agencies, abrupt shifts will not create much uproar, whether at the top or middle levels. The situation suggests a lack of cooperation between the Civil Service Commission and agency heads.

Executive orders have recently been issued removing certain policy-making positions from the classified Civil Service. Two years ago a report to Engineers Joint Council by its Committee on Civil Service anticipated many of the current problems, and urged consideration of the removal of policy-making positions from Civil Service, a check on alleged political packing, and a better analysis of qualifications of applicants.

One of the Commission's present problems is to recruit and hold the engineering, scientific, and technical workers needed by the government in this technological century, a problem which must be tackled at Commission level rather than at staff level. A bill (S. 1398), which has been introduced and referred to the Senate Civil Service Committee, directs the Commission to make a study of positions requiring technical and scientific training in the field of engineering with special reference to salaries, and to study the extent to which technical men fail to enter or to remain in federal employ. Such a study will probably involve aspects of federal employment other than salary. Reports have been requested on this bill.

Legislation

Appearing for Engineers Joint Council as chairman of its Labor Legislation Panel, E. L. Chandler of ASCE presented convincing testimony to the House and Senate Labor Committees in favor of retention of the professional provisions of the National Labor Relations Act. NSPE joined the EJC member societies in support of this testimony which was favorably received by the committees. The Engineers and Scientists of America, the new national federation of independent unions of professional technical employees, requested radical revisions in the law to facilitate unionization of engineers but severe cross examination marked this presentation.

Congressman Carl Hinshaw, of California, a prominent ASCE member, has introduced H. J. Res. 166, which would establish a Joint Committee on Science, a bipartisan committee of House and Senate members charged with the duty of keeping Congress informed on "the results of scientific research and technical development which bear upon public affairs, and the problems being encountered in maintaining in the United States a scientific and technical effort of outstanding quality and accomplishment." This committee would meet with the Board of the National Science Foundation at least once a year and could call on federal agencies for staff assistance. The bill provides for accepting the voluntary assistance of private organizations. No hearings are planned. The bill has been sent to the House Rules Committee.

Two bills provide for income equalization and retirement annuities for professional practitioners. EJC appeared in behalf of the so-called Keogh bill during the 82nd Congress. Hearings will be held this June. It appears likely that the whole matter will ultimately be considered in some bill for an overall revision of the revenue laws.

Hearings are now under way on the controversial St. Lawrence Waterway. Senator Wiley, on behalf of seventeen Senators, introduced S. 589 calling for the construction of a 27-ft channel from Lake Erie to Montreal. Power projects would be developed under license of the Federal Power Commission and a corresponding Canadian agency.

Western water projects are being vigorously debated. Some Western senators warn against cutting appropriations for reclamation projects. New large reclamation projects appear unlikely. Bills for the Bridge Canyon Dam and Hells Canyon Dam will have hard sledding. Federal Power Commission hearings for private development of Hells Canyon will be held in May. Ex-President Hoover urges the establishment of a commission "to reorganize the whole federal ventures into the power business." The House Public Works Committee has approved H.R. 4025, authorizing an additional $75,000,000 for the Corps of Engineers for three Columbia River dams.

Construction Prospects

While economy is a guiding principle it must not be assumed that engineering and construction will decline everywhere.

The Public Buildings Service will undoubtedly suffer a severe cut in appropriations and personnel. However, Defense Department expenditures for construction should go on at current levels for another year or more. The recent freeze order to permit reappraising projects has resulted in holding up some awards, but these are now getting underway. A few were definitely side-tracked. Of over $9 billion previously appropriated for defense construction, $5 billion has been obligated. For the next fiscal year, beginning in July, about $3 billion of unobligated funds will be available. Even without further appropriations this should permit design and construction contracts to proceed at last year's rate. The Air Force will spend about $1½ billion, the Navy $500,000,000 and the Army somewhat under $750,000,000 of these unobligated construction funds. More than half of this amount is for overseas projects.

ASCE MEMBERSHIP AS OF APRIL 9, 1953

Members	8,331
Associate Members	10,546
Junior Members	17,085
Affiliates	68
Honorary Members	42
Total	36,072
(April 9, 1952	34,469)

Coming Events

District of Columbia—Meeting at the Cosmos Club auditorium, Washington, D.C., on May 12. Meeting of the Junior Forum at the Engineers Club of Washington, Willard Hotel, on May 27.

Indiana—Joint meeting with the Indiana Engineering Council at the Marott Hotel, Indianapolis, on May 9, starting at 10:30 a.m. Families and friends are invited to participate in the meeting at Dunes State Park on Lake Michigan, June 6 and 7.

Kentucky—The Kentucky Section will be host to the District Nine Council annual meeting at Cumberland Falls State Park, May 15 and 16. The Section is sponsoring a joint dinner meeting of the Louisville Engineering and Scientific Council at the Kentucky Hotel, Louisville, on May 21.

Los Angeles—Annual campus meeting of the Los Angeles Section arranged by the University of Southern California Student Chapter, at "The Town and Gown" on the campus, on May 13, at 6:45 p.m. Junior Forum will meet at the Founders' Hall, Room 335, University of Southern California, May 13, at 5:50 p.m. Luncheon meetings of the Forum at the Hotel Clark Coffee Shop every Friday at 12 noon.

Maine—Annual spring conference at the University of Maine on May 9.

Metropolitan—Meeting in the Engineering Societies Building, May 20, at 7:30 p.m. Dinner meeting of the Junior Branch at Schwartz's Restaurant, 54 Broad Street, New York City, May 13, at 6:30 p.m.

Michigan—Meeting at the Engineering Society of Detroit, on May 7.

Philadelphia—Social meeting at the Engineers' Club on May 15, at 7:30 p.m. Dinner meeting of the Central Pennsylvania Subsection at the Harrisburg Civic Club, May 13, at 6:30 p.m.

Providence—Annual closing dinner meeting and election of officers at Lippitt Hall, University of Rhode Island, at Kingston, R.I., on May 14, at 7:15 p.m.

Virginia—Annual joint meeting with Engineers Club of Hampton Roads at the Hansemond Hotel, Ocean View, Va., May 22 and 23.

Scheduled ASCE Conventions

MIAMI BEACH CONVENTION
Casablanca Hotel
June 17-19, 1953

NEW YORK CONVENTION
Hotel Statler
October 19-23 1953

ATLANTA CONVENTION
Hotel Biltmore
February 15-19, 1954

NOTES FROM THE LOCAL SECTIONS

(Copy for these columns must be received by the tenth of the month preceding date of publication.)

Tilt-up construction occupied the attention of **Akron Section** members attending the March dinner meeting. Two representatives of the Portland Cement Association—W. J. Hagenlocher and Jack Kennedy—were present to explain this important new technique and to show a sound film giving step-by-step installation procedures.

Members of the **Juneau Subsection** of the **Alaska Section** were brought up to date concerning the search for fissionable materials in Alaska in a talk by Phil Holdsworth, Territorial Commissioner of Mines, given at their March 31 dinner meeting. The remainder of the program was presented by Bruce Russel, a Junior Member, who described the WASHO road test currently under way in Idaho.

The raison-d'etre of air-supported construction, which permits reduction of deadload by use of lighter materials, was explained by Edward R. Dye at the March 17 meeting of the **Buffalo Section.** Mr. Dye is head of the Industrial Division of Cornell Laboratory, Inc.

More than 300 attended the February meeting of the **Central Illinois Section**—a joint session with the Highway Users Conference. I. E. Solberg, chairman of the North Dakota Highway Users Conference, was the principal speaker, with a talk in the field entitled "On Conquest of Distance." For the March meeting, in Springfield, the speaker was Carl D. Gross, engineer for the Sanitary Engineering Division of the Illinois Department of Health. In a discussion-provoking talk, Mr. Gross pointed out "the many fallacies in flood control, with particular reference to the Kansas and Illinois river basins."

A committee of **Central Ohio Section** members is acting with interested committees of ASME, AIA, and AIEE in making joint recommendations to state legislative committees concerning a pending new Ohio State Building Code that would "seriously affect the practice of civil engineering." Speakers at the March 19 meeting were Arthur Robinson, director of public relations for the Ohio Water Pollution Control Board, who outlined recent activities of the Board, and Gene Reissig, a Junior Member, who gave a resume of the current issue of CIVIL ENGINEERING.

Students were honored by the **Cincinnati Section** at its March 4 dinner meeting—a joint session with the University of Cincinnati Student Chapter. Winners of the 1953 Section awards for the two "outstanding senior civil engineers" at the university are Robert Ballew, president of the Chapter, and George Adams. The program for the evening included two student speakers, Paul Mayer and Arvie Maynard, and three spokesmen for the Section—President Harry Balke, Neil Wandmacher, head of the civil engineering department, and George Kral.

Pressing community problems that have been the subject of detailed study by the Cleveland Regional Planning Commission were outlined by Proctor Noyes, director and secretary of the commission, at the **Cleveland Section's** March dinner meeting. Mr. Noyes' report concentrated on the sewer and water problem, the first to be tackled by the group as "most pressing."

Axel Johnson, structural engineer for the Duluth Building Inspection Department and featured speaker at the **Duluth Section's** March meeting, commented on early building codes and pointed out similarities with present codes. On February 16, the Section heard F. T. Field describe his experiences and travels in Africa.

The new Lehigh cement plant near Flagler Beach, Fla., was inspected by members of the **Jacksonville Subsection** of the **Florida Section** on March 21. Henry Burks, plant manager, explained the operation of the plant. An unusual feature of the manufacturing process is the use of coquina shells, which are mined close to the plant, as raw material. An oyster roast at Summer Haven enlivened the motor trip to Jacksonville.

Members of the **Central Savannah River Subsection** of the **Georgia Section** had M. L. Shadburn, president of the Georgia Section and Georgia state highway engineer, as principal speaker for their March 24 dinner meeting. Mr. Shadburn stressed the importance of making the public properly aware of the contributions of the profession to modern life.

In an illustrated talk, entitled "Our Mobile Earth," F. W. Christiansen, associate professor of geology at the University of Utah, told **Intermountain Section** members the facts about earthquakes, at their March 12 meeting.

Showing of a Bureau of Public Roads sound-color film on Road Test 1 in Maryland constituted the technical program for the March 11 meeting of the **Iowa Section**—a joint session with Iowa State College Student Chapter. The attendance of 150 included 62 students.

Recent engineering developments in Latin America were reviewed for the benefit of **Kansas Section** members at their February meeting. The speaker was Frank Gilmore, Kansas City (Mo.) consultant.

The **Los Angeles Section's** Junior Forum is having an active year, with weekly luncheons and biweekly meetings the rule. At a recent meeting, Forum members heard a talk on employment opportunities in South America given by Section member Joseph B. Hyde, who is in the foundation department of the Donald R. Warren Engineering Co. Mr. Hyde recently took a year's leave

of absence to work on highway construction projects in South America.

New officers of the **Louisiana Section** are Sargent F. Jones, president; Louis M. Buja, first vice-president; and Roy T. Sessums, second vice-president. C. Glennon Melville continues as secretary-treasurer, and he will be assisted by Robert H. Grehan, newly elected junior assistant secretary-treasurer.

New Hampshire members of ASCE, meeting in Concord on March 13, voted to form a New Hampshire Branch of the **Maine Section.** Petitions have been sent to the Maine Section for approval and to the Northeastern Section for release of allocated members to the Maine Section, and indications are that the necessary approval will be forthcoming.

Carrying Section activities to the membership, the **Metropolitan Section** has initiated a series of meetings to be held outside Manhattan. The first meeting—in Newark, N.J., on April 8—was a cooperative venture of the Junior Branch and the Newark College of Engineering Student Chapter. There was a large turn-out of New Jersey members to hear a talk on the 185-mile Garden State Parkway under construction in the eastern part of the state, given by Walter L. Braybrooke, assistant chief engineer of the New Jersey Highway Authority.

The **Michigan Section** is planning to be host to a summer meeting of all the Sections in District 7 at Houghton, Mich., on August 6 and 7. Other participants will be the Wisconsin, Duluth, and Northwestern Sections.

Riveters have stepped aside to make room for welders on new building construction in the Southwest. So said La Motte Grover, welding engineer for the Air Reduction Co., of New York, in the principal talk at the March meeting of the **Nebraska Section.** Because welding is cheaper and there is an additional saving in fabricating costs, "it has caught on fast," he said. The April meeting, held in connection with the Nebraska Engineering Society's annual Spring Round-up, featured a talk by T. K. May, director of technical services for the West Coast Lumbermen's Association.

An engineering panel from the Minnesota State Highway Department put on the technical program for the **Northwestern Section's** regular monthly meeting on April 6. The speakers were John H. Swanberg, engineer of materials and research, who reviewed the work of the Materials Research Division; E. C. Carsburg, concrete engineer, whose subject was "Evaluation of Pavement Roughness"; James Bingham, geologist for the department, who described procedures used in prospecting for sand and gravel by the "early resistivity" method; and Paul Felz, laboratory chief for the department, who discussed the use of plate-bearing tests in determining the bearing strength of highways.

Winners of the **Mohawk-Hudson Section's** annual prize speaking contest, held March 25, are Richard Kabat, of Union College, first prize; Enoch Carlson, of Rensselaer, second prize; and Joseph Czaban of Union, third. The Section recently modified its contest rules to place major emphasis on oral delivery rather than technical content.

Featured speaker at the March meeting of the **Oregon Section** was C. H. Ferguson, of Intrusion Prepakt, Inc., who explained the principles involved in the process and the history of its development, and noted latest uses of the product. Slides of typical installations were shown.

There was a large turnout for the March meeting of the **Philadelphia Section** to hear E. F. Ball, chief engineer of fabricated steel.

Texas Section Has Large Spring Meeting

More than 250 attended the Texas Section's spring meeting, held at College Station, Tex., April 2–4, with the Brazos County Branch of the Section as host and ASCE President Walter L. Huber and Executive Secretary William N. Carey as guests. Meeting highlights included a talk by President Huber entitled "What the American Society of Civil Engineers Has Meant to Me" (see page 62); technical sessions covering a report on the Section's service in recommending a water policy for the state, study of the engineering code of ethics, and discussion of the relation between the contractor and the engineer; the annual Texas Conference of Student Chapters; a dinner dance; and award of ASCE certificates of life membership.

President Huber presented the life membership certificates to Thomas S. Byrne, William M. Eliot, Carl E. Sandstedt, and Julian Montgomery. Recipients in absentia were Richard L. Brandt, Emil M. Gustafesen, Albert M. McPherson, and John W. Pritchett.

The Texas Conference of Student Chapters tentatively approved a new constitution and elected new officers as follows: Joe Engle, Southern Methodist University, president; Gene Hackney, University of Houston, vice-president; James White, Texas Tech, corresponding secretary; Ralph Christian, University of Texas, recording secretary; and Larry Hoffman, Texas A & M, treasurer. In the annual student paper competition among students representing the six engineering schools in the Texas Section area, first prize, consisting of $25 and a certificate, went to Nick Dameris, of Rice Institute, for his paper on "History of the Flexure Formula," and a second prize, consisting of $15 and a certificate, was awarded to Tom Waggoner, of Texas A & M, for a paper on "Engineering Marvels of the Egyptian Pyramids." All six contestants were awarded $10 each.

The fall meeting of the Texas Section has been set for October 8–10 at San Antonio, Tex., with the Plaza Hotel as headquarters.

Texas Section President Mason Lockwood presents Section's official emblem—an ASCE pin mounted in a spur tie clasp—to ASCE President Walter L. Huber.

Texas Section Board of Directors meets during Section's spring meeting. In front row, left to right, are T. C. Forrest, Jr.; Raymond Dawson; Randle Alexander; ASCE President Walter L. Huber; Texas Section President Mason Lockwood; ASCE Executive Secretary W. N. Carey; Oscar Seward, vice-president of Section; and I. W. Santry, Jr., secretary-treasurer. Standing, in same order, are Winfield Holbrook; J. D. Piper; J. W. Porter; R. L. Peurifoy; Walter Dickerson; V. J. Van Schoeler; W. E. Sampson, Jr.; Charles P. Smith; W. G. Staggs; A. D. Hutchison; Kenneth M. Smith; and J. R. Sims.

construction for the Bethlehem Steel Corp., speak on the Chesapeake Bay Bridge. Mr. Ball deplored the rigid economy that limited the structure to two lanes. The last meeting of the **Delaware Subsection** as such was a joint session with the Delaware section of the AIEE on March 2. Following dinner, the joint group saw the General Motors' popular demonstration, entitled "Preview of Progress." At the San Francisco Convention of ASCE, the Delaware Subsection was given Local Section status and hereafter will function as the Delaware Section.

Val F. Padovan, active member of the **San Francisco Section** and president of its Junior Forum, has declared June to be "Know Your Junior Forum Month." During the recent San Francisco Convention, Forum members kept the news flowing to the local papers, and assisted in many activities helping to make the Convention the success it was. Forum members interested in "learning the ropes", serve on many of the Section's standing committees. The forum was organized in 1932.

Val F. Padovan

In a talk, entitled "Limit Analysis and Design," William Prager, chairman of the Physical Sciences Council at Brown University, showed **Providence Section** members attending the March meeting how structures with ductile members can be designed to remain serviceable beyond their elastic limit.

Damage to the Golden Gate Bridge caused by high winds was described at a recent **Sacramento Section** luncheon meeting by John Kozak, of the California Bridge Department. Reporting on the findings of a three-man board set up to study the problem, Mr. Kozak said that, in 1951, a 60-mile wind caused 16-ft vertical movement accompanied by longitudinal movement of 40 in., the maximum possible movement without crushing bridge members. The situation is still under study, and the bridge is closed to traffic in high winds.

Hydroelectric and smelter site development of the huge Nechako-Kitimat project in British Columbia, was described at the March 26 meeting of the **Seattle Section** by Franklin T. Matthias, assistant project manager for the Aluminum Company of Canada.

Members of the **Tacoma Section** had their fellow member and former president, Charles Andrew, as featured speaker for their March 10 meeting. Mr. Andrew's discussion of the proposed bridging of Puget Sound was hailed as one of the most memorable talks given before the Section in recent years. An educational film, entitled "Functional Photography in Industry" was shown by the Eastman Kodak Co.

A student paper competition to screen contestants for the Texas Student Conference was the highlight of the annual joint meeting of the **Houston Branch** of the **Texas Section** and the Rice Institute Student Chapter, which was notable for the interest and enthusiasm shown by the younger members. Nick Dameris won first place in the contest with a paper entitled "History of the Flexure Formula." Prof. Albert J. Bonar has been elected vice-president of the Branch, replacing Adrian Pauw, who has accepted a new position with the University of Missouri. James C. Fuller, public relations director for the Bell Aircraft Corp., spoke on the "Use of Helicopters in Civil Engineering" at the March 9 meeting of the **Fort Worth Branch.** On the same date Pliny Gale, executive vice-president of Jack Amman, Photogrammetric Engineers, spoke before the **San Antonio Branch** on the various applications of photogrammetric engineering.

The featured speaker at the March meeting of the **Toledo Section** was Ellis Root, construction engineer for the J. E. Greiner Co., who discussed the Ohio Turnpike Project.

New ECPD Career Booklet Is Issued

A new career booklet, *Engineering—A Creative Profession*, has been published by Engineers Council for Professional Development and may be obtained from the headquarters office of the organization at 29 West 39th Street, New York 18, N. Y. The price of the interesting illustrated publication is 25 cents a copy, and for purchases of fifty or more copies in bulk there will be a 20 percent discount. To facilitate ordering, a coupon has been provided on page 116 of the advertising section.

Replacing *Engineering—A Career*, this new portrayal of the who, what, where, and why of engineering will serve as an ECPD basic guidance pamphlet for the engineering profession. The former guidance publication is out of print.

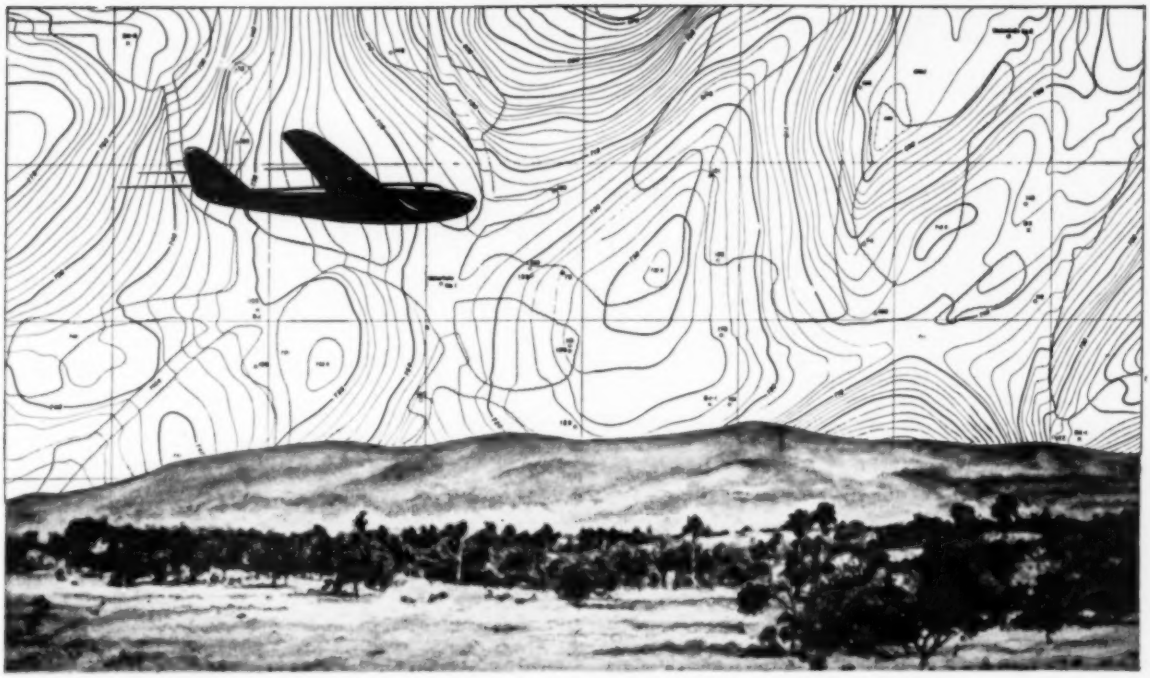
UPADI Papers Given at New Orleans Available

The proceedings of the UPADI (Union Panamericana de Asociaciones de Ingenieros) Convention of United States and Latin-America engineers, held in New Orleans, La., August 25-30, 1952, are available in Vol. I, No. 3 of the *Boletin de la UPADI*, official publication of the organization.

Inquiries concerning the bulletin, which is printed in Portuguese, Spanish, and English, should be addressed to Engineers Joint Council, 29 West 39th Street, New York 18, N.Y.

West Virginia Section Meeting Arranged by Juniors

Roy J. Morton (seated left), leader of Health Physics Division of Oak Ridge Naticnal Laboratory, is shown with West Virginia Section officers at Section's March 27 meeting, at which he spoke on problems presented by radioactive waste materials. Shown with him are Kenath A. Kettle, president of West Virginia Section (seated) and (standing, in usual order) R. F. Baker, vice-president of Section; Ralph N. Shepard, past-president of Section; ASCE Director George W. McAlpin; and Fred R. Palmer, vice-president of Section. The program was arranged entirely by Junior Members.



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NEWS BRIEFS . . .

AGC Takes Action on Industrial Problems At Its 34th Annual Convention in Miami

The deepening responsibility of the construction industry to the national welfare was the dominant theme of sessions of the 34th annual convention of the Associated General Contractors of America, held in Miami, Fla., March 23–26. More than 1,800 general contractors and other construction representatives assembled from all parts of the country to review the industry's greatest year and the contributions of the association to construction progress, making it the largest AGC annual convention on record. The close relationship of the industry to the economy of the nation was apparent from the range of topics discussed, and from the fact—brought out in the various discussions—that one out of every eight dollars received for goods and services in the nation's market place is a construction dollar.

Conditions expected by the industry in the next six months were reported to the convention from a survey of the association's directors and chapters. On the basis of the removal of controls and the general availability of materials, the speakers forecast a period of abundant work. The survey revealed, however, that intense competition, sharp bidding, and lower prices are in the offing—"further assurance to the public that it will receive full value for its investment in construction."

Taking into account these conditions, the convention passed resolutions urging the improvement of contract documents, specifications, and administrative procedures that would lead to more economical practices on both public and private construction; better pay for construction engineers on municipal and other public work; expansion of apprentice training; and the review of all federal expenditures with a view toward balancing the budget. Other resolutions recommended policies for the most economical continuation of defense construction; the adoption of policies that will enable members and the association to work for the stabilization of wage rates and improved labor-management relations; and procedures for federal and other government units in obtaining more adequate financing of the nation's highways.

Separate meetings of the various divisions considered the problems pertinent to their types of construction. Among such groups meeting were the Building Contractors' Division, which considered measures adopted by various federal contracting agencies in response to AGC proposals and relationships with subcontractors; the Highway Contractors' Division, which found the problem of highway financing the most important topic; and the Heavy Construction and Railroad Contractors' Division, which reviewed the progress of AGC task units seeking specification adjustments with federal agencies.

In his address opening the convention, President A. S. Horner, A.M. ASCE, made some forecasts of his own. He said, "I believe that the construction industry, and this association, has before it perhaps its greatest opportunity for helping in the growth and development of our nation and its communities.

"We all keep thinking of the future and wondering if construction levels can continue high. The facts are that in construction the need for most kinds of construction is now also at an all-time high. We need thousands of classrooms each year for the growing number of school children. The demands of traffic are increasing so rapidly and our highways are deteriorating at such a rate that current construction is not even keeping pace with the need. Our need for water systems, the development of natural resources, and many other things is such that we cannot catch up with demand for many years.

"Our great opportunity now," Mr. Horner concluded, "is to demonstrate by our actions, individually as contractors and collectively as an association, to the public that the projects which they need will be built with a maximum of skill, integrity, and responsibility."

Other major speakers were Under Secretary of Commerce Walter Williams; Maj. Gen. Samuel D. Sturgis, Jr., Army Chief of

All-Welded Building Started for Downstate Medical Center of State University of New York

Construction of new $14,500,000 Basic Sciences Building of the Downstate Medical Center of the State University of New York began April 9. The eleven-story structure, shown here in artist's rendering, will have an all-welded steel frame. The main axis of the building is 648 ft long and about 58 ft wide. The facing will be light brick with stone trim, and the windows are steel double hung. Facilities will include laboratories, lecture halls and offices for 800 medical students and 275 members of the faculty and staff. A wing at the rear of the building will enclose a four-story library and cafeteria. Present plans provide for future expansion of the structure to include facilities for dental, nursing and public health students when the Center is enlarged to include these schools. The site of the project is Clarkson and New York Avenues, Brooklyn. Architects are Eggers & Higgins, and the structural engineers, Weiskopf & Pickworth. Construction cost of the project will be $12,079,557, with the construction contract let to Cauldwell-Wingate.

Venezuela Builds Second Concrete-Arch Bridge

Forms for second of three nearly identical bridges on Caracas-La Guaira Superhighway in Venezuela were raised 106 ft into position in 3½ hours in presence of group of Venezuela officials on February 12 (right-hand photo). The hollow concrete-arch rib is shown in place in the upper view taken in March. Erection of the first of the three bridges, was described in the March issue. Engineers are Entreprises Campenon Bernard, with Robert Shama, M. ASCE, chief engineer.

Engineers; Capt. A. D. Hunter, Deputy Chief of the Navy Bureau of Yards and Docks; and Carlton S. Proctor, Past-President of ASCE. In one of his first public appearances since his confirmation as Chief of Engineers, General Sturgis pointed out the challenging nature of the military construction program, which "is necessarily based on decisions subject to changes generated by the continual shifts and maneuvers of global strategy." Mr. Proctor described the need for "a spiritual mobilization coincident with our material mobilization."

At the conclusion of the meeting, C. P. Street, of McDevitt & Street Co., Charlotte, N.C., was installed as president, succeeding A. S. Horner. John MacLeod, of the Macco Corp., Paramount, Calif., was installed as vice-president.

Operation of Submarine Thermal Reactor Begins

The submarine thermal reactor prototype plant has successfully entered its first phase of operation at the National Reactor Testing Station in Idaho, according to an announcement from the Atomic Energy Commission. In this phase, which is identified as "criticality," the nuclear components of the reactor are sustaining an atom fissioning chain reaction. Further testing and operation will continue until the plant is gradually brought to full power in order to determine the operating characteristics of a similar unit that will power the *U.S.S. Nautilus* and to train a crew for the vessel.

Construction of the submarine thermal reactor plant in Idaho and the plant for the *U.S.S. Nautilus* is a joint project of the AEC's Argonne National Laboratory, the Atomic Power Division of the Westinghouse Electric Corp., and the Electric Boat Division of the General Dynamics Corp., assisted by numerous subcontractors. The project has been under the administrative and technical direction of the AEC-Navy group in the Division of Reactor Development of the AEC.

New Bid Received On Thruway Bridge

With receipt of a low-bid of $28,807,092 for construction of the steel superstructure of the Tappan Zee Bridge, which will carry the Thruway over the Hudson between South Nyack and Tarrytown, Bertram D. Tallamy, A.M. ASCE, state public works superintendent and chairman of the Thruway Authority, announces plans for completion of the 15,000-ft structure by the fall of 1954. The low bid was submitted by the American Bridge Division of the United States Steel Corp.

Original plans for the Tappan Zee Bridge called for a tied-arch design, which was abandoned in favor of a cantilever-truss design when no bids were received on the tied-arch project (March issue, page 79). The new design changes only the center span, which is about half a mile long and will be erected over the main navigation channel. A 1.6-mile approach will connect the span to the west bank and a .8-mile approach to the east bank. According to Mr. Tallamy, substitution of the cantilever-truss design has permitted savings of several million dollars in building the bridge.

Madigan-Hyland of Long Island City, N.Y., are consulting engineers on the project.

Plans for Mackinac Straits Bridge Shelved

Plans for construction of a suspension bridge across the Straits of Mackinac, between Mackinaw City and St. Ignace (described in the April issue, page 78), have been killed, for the time being at least, by unwillingness of bonding houses and insurance companies to finance construction of the project and by failure of the Michigan legislature to appropriate funds for its maintenance. The state-operated ferry line operating across the straits has been losing more than $500,000 a year for the past four years. Prospective investors had wanted the state to back their investment by allocating a similar amount annually for operation and maintenance.

Total cost of the 3,800-ft suspension span, which would have been the second longest in the world, was estimated at $96,000,000.

New Consulting Firm for Prestressed Design Formed

Establishment of a new firm of consulting engineers in prestressed design, called Preload Engineers, Inc., with offices at 955 North Monroe St., Arlington, Va., is announced. Formed from the Preload Company, Inc., pioneers in prestressing in North America, the new firm will provide an organization concerned solely with the design of prestressed structures, such as buildings, bridges, tanks, pipelines, and pavements.

Senior members of the new firm are Curzon Dobell and Eric Molke, Members ASCE, E. H. Thwaits, and Cedric C. Stainer.

Bids on Generators for Chief Joseph Dam Rejected

Rejection of all bids made for elements of the multi-million dollar Chief Joseph Dam under construction at Brewster, Wash., in favor of further Army study of the project, is announced by the Department of Defense. With the English Electric Export and Trading Co., Ltd., underbidding competing United States companies for the purchase and installation of both generators and transformers for the project, the rejection of bids poses the question of whether the new administration intends to make it more difficult for foreign companies to compete with American bidders.

In a directive issued last June, the ECA sought to guarantee that, "Competitive bids from sources in the United States and friendly foreign countries be considered on a common basis." Though the Corps of Engineers has no specific policy in the matter, it has awarded good-sized contracts to foreign firms within the past year. Since late in 1951, when it won a fight to award low-bid contracts, the Bureau of Reclamation has given 19 contracts to foreign companies in competitive bidding.

The English Electric Export and Trading Co., Ltd., made a low bid of $4,406,493 for the generators, and $1,831,880 for the transformers.

More Water Power Held Available on Oregon Coast

Oregon's coastal streams can be developed to produce approximately 200,000 kw of continuous electric power, or 600,000 kw available from November through February, according to a recently released report of the Water and Power Branch of the U.S. Geological Survey. The report, which represents more than a decade of surveying and study, does not propose any major development of water power on the coastal streams at this time because of relatively high construction costs. It suggests instead that potentialities be more fully investigated, with due attention to the economics of normal construction costs and associated problems. Though substantial storage capacity is available, it would be necessary to relocate highways, roads, and rail lines, adding heavily to the total cost. The present report, therefore, merely assembles all available information with the expectation that new sources of power will be needed after the development of more economical projects in the Columbia Basin is completed.

Entitled the *Water Power of the Coast Streams of Oregon*, the report is based on individual studies of the Alsea, Coos, Coquille, Nestucca, Nehalem, Siletz, Siuslaw, Trask, and Wilson rivers. These streams have a heavy winter flow, but a negligible discharge in later summer and fall. Storage achieved through the construction of dams at recommended sites would enable use of all their annual runoff from November to February, when Columbia River water is low and supplemental power is urgently needed in the Pacific Northwest.

A limited number of free copies of the report is available from the U.S. Geological Survey, General Services Building, Washington, D.C.

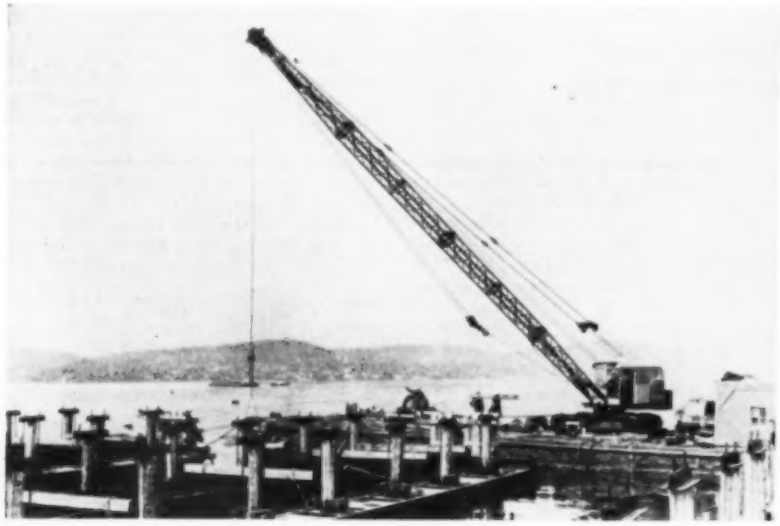
Hydroelectric Construction In Canada at Record High

Keeping pace with the general industrial activity throughout Canada, the record high total of 1,066,250 hp of new hydraulic turbine capacity was brought into operation in 1952, according to a recent report of the Canadian Minister of Resources and Development. Active construction was also proceeding on other developments with a total ultimate capacity of more than 3,000,000 hp.

Although new developments were widely distributed throughout the Dominion, the greater number were located in the Province of Quebec, with 597,000 hp of new capacity completed during the year. The Quebec Hydroelectric Commission was actively engaged on several developments. At Beauharnois, on the St. Lawrence River, capacity was increased by 22,000 hp in four units, and two other units were under installation for 1953 operation that will bring total capacity of the over-all development to 1,408,000 hp. On the Bersimis River a large development—with initial capacity of 300,000 hp (by 1956) and ultimate capacity of 1,000,000 hp—is being undertaken. Power from this project will be transmitted across the St. Lawrence River to the Gaspé Peninsula, and the plant will be tied in with Beauharnois by a high-voltage line. The Aluminum Company of Canada completed its five-unit 275,000-hp development at Chute du-Diable on the Peribonka River and brought into operation one 55,000-hp unit at Chute-a-la-Savanne, a few miles downstream. The latter plant, also of 275,000 hp, will be completed in 1953, and both plants will be tied in with Saguenay River generating stations.

In Ontario, which is second in both installed and new capacity, the Hydroelectric Power Commission of Ontario brought into operation seven of the eight 33,000-hp units in the Otto Holden Generating Station on the Ottawa River, and made good progress on many phases of construction of the Sir Adam Beck–Niagara Generating Station No. 2 on the Niagara River, which will have an ultimate capacity of 1,260,000 hp in twelve units. In British Columbia, which ranks next to Quebec and Ontario in capacity, progress was made on the Aluminum Company of Canada's great Nechako-Kitimat development, and work was well up to schedule for initial operation in 1954.

Early Construction for Tappan Zee Bridge



Heavy construction equipment is assembled in the middle of the Hudson River, near Nyack, N.Y., for use in erecting the west span of the New York State Thruway's Tappan Zee Bridge between South Nyack and Tarrytown. A major structure in the Thruway project, the bridge with its approaches will be 6 miles long—3¼ miles over the water. Width will be 95 ft, and height above water 160 ft. Photo shows Lorain L50-K crane lashed to a barge. Equipped with a 70-ft boom, the machine handles steel and lumber loads ranging up to 24,000 lb on the job. The crane is owned by the Construction Aggregates Corp., of New York, which has one of the foundation contracts.

Improvement of New York Waterfront Authorized

The Port of New York Authority has authorized an $8,276,000 project for the first stage of construction and rehabilitation of its Hoboken piers, as a part of the Hoboken waterfront improvement program undertaken by the bi-state agency under the terms of a recent lease with the city. Scheduled for completion early in 1955, the first stage of the project will include construction of a new pier (to be called Pier C) and the rehabilitation of existing structures. The pier, which will be about 660 ft long and 345 ft wide, will be the city's first new pier in 25 years.

The second stage of the Hoboken waterfront development calls for construction of a similar pier within eight years. It will bring the city's financial commitment under the lease to $15,000,000. At its option, the Authority may construct a third pier later.

Westinghouse Corp. Organizes Atomic Equipment Department

Commercial use of atomic power is a step nearer realization with an announcement from the Westinghouse Electric Corp., of plans for a new, multi-million-dollar plant for production of atomic equipment. The plant will be operated by a newly formed department in the Atomic Power Division—the Atomic Equipment Department. The new facility, believed to be the first major private enterprise of its kind anywhere, will be located in Harmar Township, near Pittsburgh. At it, the company will engineer, manufacture, and sell products that have been developed for atomic power plants. At present the products of the new Atomic Equipment Department will go to government atomic projects.

The Westinghouse Corp. formed its Atomic Power Division in October 1948 in an effort to contribute to the nation's defense program. Since then it has been engaged in development and construction of an atomic power plant for the nation's first atomic-powered submarine, and now also holds a development contract for a similar power plant to drive a large Naval vessel such as an aircraft carrier.

AICE Elects 1953 Officers

New officers elected by the American Institute of Consulting Engineers for 1953 are Scott Turner, president; Charles E. De Leuw and Elmer K. Timby, Members ASCE, vice-presidents; Leslie G. Holleran, M. ASCE, secretary; and George C. Diehl, M. ASCE, treasurer. Elected to the AICE Council for a three-year term are ASCE Director Francis S. Friel; Clinton D. Hanover, Jr., M. ASCE; and Scott Turner.

Early Damage to WASHO Test Road Analyzed

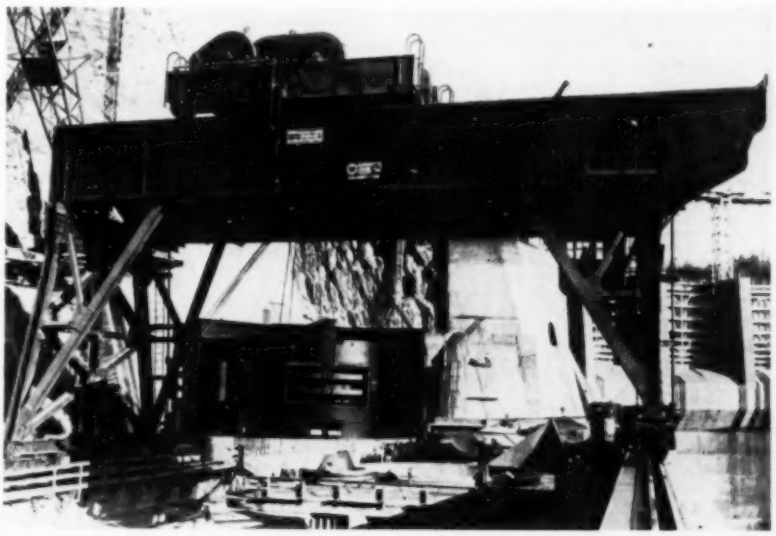
The nature and general extent of damage to the WASHO test road caused by the 17,000 heavy axle applications which were applied in tests last fall are described in a release from the Highway Research Board. There are five different pavement thicknesses, ranging from 6 to 22 in., in each of the two loops of the test road. These were selected by engineers to cover conditions of average design, over-design, and under-design for both the contemplated test traffic and the construction materials used.

According to the Highway Research Board, the 1952 test traffic caused appreciable cracking and displacement of the surface in the two 6-in.-thick test sections that were constructed with only 4 in. of granular base and 2 in. of asphaltic concrete surfacing over the subgrade. Under the heaviest tandem-axle loads, surface cracking was also noted in small areas of some of the thicker sections. In all the thicker and most of the thinnest sections, thin bituminous skin patches were used to retard the development of cracking sufficiently to permit continuing the test traffic. More extensive emergency repairs, involving removing the existing pavement and replacing it with a thick granular base and new asphalt surface, were required for certain small areas of the thinnest section under the heaviest loads, in order to maintain test traffic. No damage whatever was noted in 18 of the 23 test sections.

Located about half way between Ogden, Utah, and Pocatello, Idaho, the WASHO Road Test project is sponsored by eleven Western highway departments with the cooperation of the Bureau of Public Roads, the Automobile Manufacturers' Association, the Truck Trailer Manufacturers' Association, the petroleum industry, and others. The Highway Research Board is in charge of administration and operation of the research.

Test traffic consisting of 18,000 and 22,400 single-axle loads on one test loop, and 32,000 and 40,000 tandem-axle loads on another, was operated last fall. The tests were stopped during the winter. Now three special studies of deflection under various axle loads are being made on the test road. These studies will provide the engineers with data showing the relative deflection in the pavement under moving trucks with single-axle loads varying from 8,000 to 22,400 lb and tandem-axle loads from 14,000 to 40,000 lb. After completion of the studies, which will take about two months, regular full-scale test operations will be resumed.

Large Power Station Goes Into Service in Idaho



Critical power shortage in Idaho is relieved by the Washington Water Power Company's new Cabinet Gorge Hydroelectric Station near Clark Fork, where the third of four big generators was placed in service in February. Shown here is a 275-ton gantry crane, designed and built by the Bedford Foundry & Machine Co., Bedford, Ind., for the work of placing the generators and installed by Ebasco Services, Inc. Intended for general service work over the turbine area, the crane is designed to withstand temperature extremes in full-time outdoor service and has safe overload capacity to handle the massive rotors weighing up to 330 tons each. Though the 200,000-kw plant was considered one of the most difficult of access and construction in North America, modern methods and equipment and a crew of 1,700 workers at the construction peak brought the first of the generators into service in 21 months. The fourth generator is scheduled to go into service in July 1953.

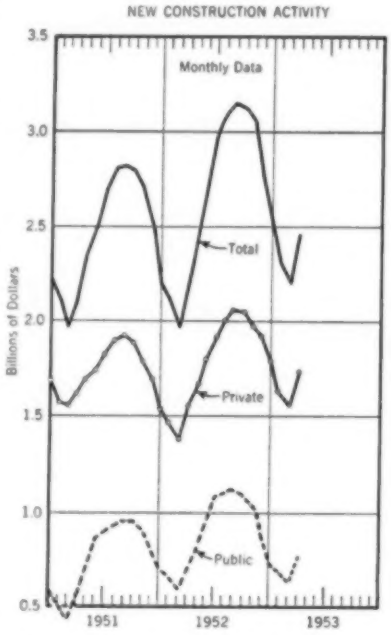
Construction Expenditures Reported at Record Level for First Quarter

Outlays for new construction increased by 10 percent during March to $2.5 billion, rounding out a record first-quarter total of $7 billion, according to preliminary estimates of the U.S. Labor Department's Bureau of Labor Statistics and the Building Materials Division of the U.S. Department of Commerce. The January–March total also represents a first-quarter record for work actually done on new construction, after allowance for higher costs is made.

Private construction expenditures rose considerably more than seasonally to $1.7 billion during March, and accounted for the greater part of the over-all gain from February. During the first quarter, private outlays, at 7 percent above the January–March 1952 level, totaled almost $5 billion. Residential building activity accounted for nearly half this amount following a rise of 12 percent during March.

Further expansion of private industrial building brought expenditures for this type of construction in the quarter just completed to near peak level. Commercial building expenditures in the first quarter of 1953 topped last year's first-quarter total by 44 percent, and private outlays on public utilities were also running higher this year—mainly because of new construction in the electric light, power, and gas-utility group.

Public construction expenditures rose 12 percent during March, to $725 million. The increase was less than usual for the time of year, however, and reflected the lag in federal contract awards following a Budget Bureau order in February to review construction projects for essentiality. Public outlays for new construction put in place during the first quarter of 1953, at $2 billion, were only slightly above the January–March 1952 figure, and mainly represented defense-connected construction and highway work. Public expenditures for housing, hospital building, and conservation and development work were all at lower levels this year than during the 1952 first quarter.



Increase of 10 percent in construction outlays in March, shown here in Department of Commerce curves, rounds out record first-quarter total.

Large Subcontract Given For AEC Portsmouth Plant

Award of a large subcontract for sheet-metal construction work on the Atomic Energy Commission's new gaseous diffusion plant being built near Portsmouth, Ohio, is announced by the AEC. The subcontract, estimated at $30,000,000, was awarded to George Koch Sons', Inc., of Evansville, Ind., on a cost-plus-fixed-fee basis by Peter Kiewit Sons' Co., general construction contractor for the project.

Work under the subcontract includes the installation of all sheet-metal and allied work on the project, such as heat and ventilation systems and process and pipe enclosures. It will take about four years to complete.

Another Call for "Who's Who in Engineering" Data

Compilation of the seventh edition of *Who's Who in Engineering*, which has been under way for the past few months, is arousing exceptional interest and response on the part of the profession, according to the editor, W. S. Downs. With indications pointing toward a high percentage of qualified engineer coverage, there is still time for supplying new data or for revising records already printed. A campaign to locate engineers whose former addresses are no longer correct is under way, and those who have not received any communication on the subject are urged to address the publisher without delay—Lewis Historical Publishing Company, Inc., 265 West 14th Street, New York 11, N.Y.

Chain of Rocks Canal Aids Mississippi River Shipping

Mississippi River traffic is now moving through new $40,000,000 Chain of Rocks Canal, which bypasses treacherous seven-mile reach of river near St. Louis. To be dedicated in May, project marks completion of more than six years of construction under supervision of Corps of Engineers. Canal varies from 10 to 45 ft in depth, tying in with 9-ft channel that the Corps of Engineers maintains throughout the length of the river. Main lock is largest in the Western Hemisphere, with surface area greater than the Panama Canal locks. The lock extends 1,200 ft, and an auxiliary lock is half as big. Each is 100 ft wide and 92 ft high. Shown here making first passage through the canal is "Joseph Lewis" of Vollmar Brothers Construction Company.

The Surveyor's Notebook

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Jack Goggin, Marathon, Fla.

Thousands of copies of the collected articles from the first year's series have gone out to surveyors who asked for them. In fact, requests from field men were so numerous that a third printing is nearly exhausted.

And now we are pleased to announce that the second year's stories and tips from "The Surveyor's Notebook" have been gathered together and reprinted in permanent form.

Tractor and Level Whip Mud Flats

The problems and "tricks of the trade" in Series 2 are new. George Gabus of New York City's Board of Water Supply, for instance, tells you his method of eliminating errors in precise alignment. A Cleburne, Texas, surveyor relates what can be done about weather conditions hampering every man in the field.

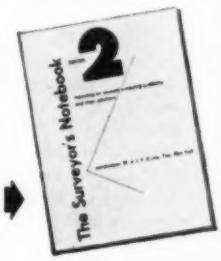
On one page, Chicago's George Salter shows how to subdivide 50,000 acres into nearly 200 lots in accordance with the rights of 600 people. On another, Maryland's Wesson Cook gives his method for bringing in stations in the muck of the Red River Valley.

Surveying the Antarctic

The Virginian Railway Company's Henry Stanley will cause a great deal of comment, we are sure, with his use of the gradienter in rough terrain; and G. W. Herzog of Shell Oil Company may surprise you with his use of a level on a tractor for whipping mud flats.

"A Bit More Mauka, a Few Feet Makai" describes how Prof. Russell Brinker of VPI solved unique problems in tracing old land deeds in Hawaii. And Comdr. Richard Black recounts his adventures while surveying the Antarctic.

John Goggin's method of determining in the field, without calculation, whether or not a survey closes will solve many a headache, as will S. E. Huey's page on getting more out of your compass. And a New Hampshire forester and land surveyor, Gerald Hyde, even tells how a surveyor can add new business with alignment jobs *inside* industrial plants.



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Chicago Starts Underground Parking Garage

On the Chicago lakefront work begins on a new 2,300-car underground garage, following award of the $6,539,539 contract for the three-level project to John Griffith & Sons, general contractors. Much of the garage will lie directly beneath busy Michigan Avenue, making construction speed vital in order to minimize traffic detours and tie-ups. In the photo, a P & H Model 255-A Truck Crane is hauling out old concrete from previous construction.

India Receives Funds for Damodar Valley Project

The International Bank for Reconstruction and Development announces a loan of $19,500,000 to India for further development of the Damodar River Valley. The loan will be used for a group of projects in a long-range program for the development of the valley, including two multi-purpose dams, each with a hydroelectric plant, and an extensive irrigation system, including a diversion dam on the Damodar River. Other major projects in the long-range program include the recently dedicated Bokaro steam power plant, a power transmission system, and a storage dam at Konar.

In addition to containing India's richest mineral resources, the Damodar Valley with its surrounding area is the most highly developed industrial region in the country. In it are located India's largest iron and steel plants, its largest fertilizer plant, the government locomotive works, and cement works.

Photogrammetric Award Available for Students

To stimulate interest in photogrammetry, the Bausch & Lomb Optical Co., Rochester, N.Y., is offering a new annual award in the field. The award, which was announced at a recent meeting of the American Society of Photogrammetry in Washington, is open to any regular student in a recognized college or university in the United States. First prize is $100 and a three-year, paid-up membership in the society, and there are two second prizes of $50 each, plus one-year membership.

The awards will go for papers of not more than 4,000 words, describing a new use for photogrammetry or photogrammetric equipment, or describing an adaptation or improvement in the use of the science. Inquiries should be sent to Bausch & Lomb.

Surveyors and Mappers Have Annual Meeting

"Map Uses" and "Engineering Surveys and Maps," as the sources of information essential to economic planning and development, were the featured topics of the thirteenth annual meeting of the American Congress on Surveying and Mapping, held in Washington, D.C., March 23–25. The attendance of over 1,000 included mapping experts from all over the world as well as representatives of government agencies, private industry, the military, engineering firms, and other groups in this country.

The Hon. Sinclair Weeks, new Secretary of Commerce, addressed the opening session of the three-day program, and Rear Admiral R. F. A. Studds, director of the U.S. Coast and Geodetic Survey, officially opened the exhibits, the most extensive and varied ever staged by the Congress. There was a special luncheon for foreign dignitaries, with Dr. A. C. Simonpietri, Secretary General of the Pan-American Institute of Geography and History, presiding.

The time and money spent on control surveys by municipalities are saved many times over for the taxpayer, according to B. H. Kock, principal engineer for the Cincinnati Department of Public Works. He placed the value of the 1873 Cincinnati survey, which is still in use, at $250,000—or 100 times its cost. The value of control surveys to industry was presented by G. W. Herzog, of the Shell Oil Co., Houston, Tex., who asserted that such surveys make a "very tangible contribution to the national economy and defense by greatly reducing the cost of the search for oil." The importance of control surveys for conservation work was emphasized by Marshall S. Wright, of the Office of the Secretary, U.S. Department of Agriculture. In another paper Floyd Hough, chief of the Geodetic Division of the Army Map Service, pointed out the need for "dense networks of control" for defense purposes.

The many other topics of special interest to civil engineers included contour-interval problems, discussed by George D. Whitmore, chief of research and technical control topography, U.S. Geological Survey; international cooperation in mapping, discussed by Brig. Gen. Albert C. Lieber, assistant chief of military operations, Department of the Army; and locating hurricanes by radar, described by Joseph Weil, head of the Engineering School at the University of Florida.

Perforated Pipe Sumps Solve Drainage Problem

Use of perforated pipe sumps eliminates problem of recurring floods at busy street intersection in El Segundo, Calif., without either storm drainage or natural runoff. Two holes were dug to depth of 20 ft on either side of street and 35-ft sections of 48-in.-dia fully perforated corrugated metal pipe—supplied by Calco Division of Armco Drainage & Metal Products, Inc.—were lowered into place. Digging then proceeded to full depth, and pipe was lowered to full depth. Conventional curb inlet was built with 12-in. corrugated pipe lead-in to the sump, and manhole cover with cast-iron ring was installed on sump to permit cleaning. Success of installation in several heavy rains has led City of Long Beach to order six similar sumps, each 45 ft long.

WESTERN *licks "Chicago Clay"*

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A steel drive-tube of sufficient length with close-fitting steel core, is driven into the ground. The core is removed and the closed end pipe section is driven out of the tube using the core as a follower. Foreign matter is excluded from the drive-tube by a gasket attached to the upper end of the pipe. When the driving of the pipe has been completed a corrugated shell is screwed down over the dogs (or anchors). These anchors are welded onto the pipe and develop a strong mechanical bond between the two sections. When required by site conditions, an alternate water-tight slip-joint is used. Both sections are then filled with concrete.

The subsoil at the site of the Regional Office and Clinic Building of the Veterans Administration in Chicago, is "Chicago Clay" at its worst. In view of previous foundation difficulties in this area, piling specifications placed full responsibility on the foundation contractor, while allowing a wide choice as to pile type and procedure. Western's Projectile pile was selected.

It was necessary to obtain approval of the type and method of installation. In accordance with the specifications, two groups of seven Projectile type piles each were driven and one pile in each group was subjected to an 80-ton load test. Measurement of tested piles showed less than 0.3 inch settlement under 80 tons. Specifications permitted 0.6 inch. This testing operation required 12 days.

Upon approval from the Veterans Administration, driving of the contract piling was started. Installation of 1380 piles was completed in 45 working days.

As the job progressed, five additional load tests to 80 tons each were conducted on piles selected by the Veterans Administration Resident Engineer. All were similar in behavior, with a net settlement of less than one-half of the allowable. No measurable horizontal movement of individual piles or groups of piles was detected. Although all piles were redriven, as required by the Specifications, practically no movement occurred, indicating that the slight heave which had been observed in the lower section, was due to compaction of the hardpan under the bottom of the pile.

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Missouri Basin Survey Commission Reports

Ralph R. Marlette, A.M. ASCE, Instructor, Department of Civil Engineering, University of Nebraska, Lincoln, Nebr.

The Missouri Basin Survey Commission has transmitted to President Eisenhower its report of a study of the land and water resources development of the Basin. Created a year ago by President Truman and organized in April 1952, the commission has held 17 public hearings in the 10 states of the Basin, heard the testimony of federal and state agencies engaged in development programs, and reviewed the analysis of current programs prepared by its own small staff of engineers, agriculturists, economists, political scientists and lawyers.

The commission members are James E. Lawrence, editor of *The Lincoln Star*, chairman; Senator Thomas C. Hennings, Missouri, vice-chairman; Senator Milton R. Young, North Dakota; Senator James E. Murray, Montana; Rep. Clifford R. Hope, Kansas; Rep. Wayne N. Aspinall, Colorado; Rep. James W. Trimble, Arkansas; Dean H. T. Person, M. ASCE, University of Wyoming; Fred V. Heinkel, chairman of Missouri Farmers Association; Harry J. Peterson, secretary of Minnesota Cooperatives; Kenneth Holum, former member of the South Dakota Senate; and Paul J. Cannell, M. ASCE, executive director. Though both political parties and diverse Basin interests are represented on this list, the members reached general agreement on all issues except the procedure for establishing a central organization to supervise the Basin-wide resources development program. All recognized the need for such an organization and for insuring local people a voice in its decisions.

It was the opinion of the majority that since the federal government has financed all projects now built or under construction, Congress should create a commission to be appointed by the President to direct the federal program in the Missouri Basin. Each state would have the right to reject the operation of such a commission within its borders by action of its legislature or by direct vote of the people. The minority (three of the eleven members) held that the states as representatives of the people should exercise a major voice in any organization operation in the Basin, and recommended negotiation of a compact between the states and the federal government to establish a Basin-wide supervisory commission.

Goals set forth by the commission for the development of the Basin include: A comprehensive program of all the land and water resources of the Basin as a whole; a provision that persons affected by the program should have every opportunity to take part in formulation of the program; the combined authority of the state and federal governments in carrying out the program; a provision that each project in the program offer total benefits in excess of all costs; and a provision that the program recognize the Basin's limited supply of water and be based upon a sound preference of use. Preference of use was suggested in the following order: municipal, domestic and pollution control; irrigation, ground-water recharge and industrial consumption; hydroelectric power; fish, wildlife and recreation; and navigation.

An economic analysis was made of several hundred projects authorized and proposed for the Basin. The wide variation in the practices of the Corps of Engineers and the Bureau of Reclamation in the allocation of project costs was found to be striking. The analysis of multiple-purpose projects indicated that the allocation of costs to non-reimbursable features may in some cases exceed the benefits and so increase the cost to the public. Estimated savings from navigation do not provide a favorable benefit-cost ratio for navigation's share of either bank-stabilization projects or upstream dams. The commission found it questionable if navigation should be continued as an objective of the Basin development.

The Missouri Basin program is a long-range venture now estimated to cost $16^3/_4$ billion. It breaks down about as follows:

Irrigation, 29 percent; watershed programs, 28 percent; flood control, 23 percent; power, 15 percent; navigation and channel stabilization, 4 percent; and municipal water supply and recreation uses, 1 percent. Agency participation in this program is: Corps of Engineers, 23 percent; Bureau of Reclamation, 28 percent; Department of Agriculture, 18 percent; and local participation in the USDA program, 31 percent. Although but a small portion of the program has been completed, the Corps of Engineers has $15 or $16 million worth of work under construction in the Basin and the Bureau of Reclamation has scheduled another $20 million worth of projects to start before 1960.

N. G. Neare's COLUMN

R. ROBINSON ROWE, M. ASCE

"Joe, you look a bit nonplussed," sympathized the Professor. "Which of the 6 little verbal arithmetic problems is bothering you?"

"I'm nonplusseder than you think," moaned Joe Kerr. "I was so fascinated by the 6th problem, ARTAxERxES = LEADER that I wanted to compose one of my own to a similar pattern. For the pattern, I needed another word with two interior x's. I've been poring over an unabridged for a whole frustrated month and I'm stumped unless I coin something like *box-fixer* or *exlaxed*."

"Then suppose I give you *hexaxon* and *maxixe* from my list to relieve your nonplussage and ask Cal for the answers to the 6 assignments."

"I have 37 answers," bragged Cal. "The fantastic reaction OxYGEN = XENON can be done by 6x2978 = 17868 and 4 isotypes. The axiomatic VExING = MATH led me on to 28x157 = 4396 and 6 larger products. Of the 12 recipes for OxTAIL = SOUP, the thinnest was 2x1645 = 3270. For BOxWOOD = SCALE, 12x4228 = 50736 was the slimmest of 4 patterns. The childish MIxMUD = PIES took 7 forms, of which the flattest was 17x159 = 2703.

"Like Joe, I liked ARTAxERxES = LEADER best. It was easy to show that E<3 to keep the product in 6 digits. Also that when E = 2 we must have A = 1; to make a final digit R of AxRxS, I had only to try R,S = 0,6; 4,6; 5,3; and 5,7. When all failed, I knew E = 1 and some simple algebra limited R to 0,2,4,5,6 and 8. For each of these except R = O, I tried the few combinations of A and S which would yield the right final digit. When these failed, I knew R = O and the rest was easy. Just divide the equation thru by 10 to find that AxS must give a final digit E = 1. Neither can be 1 and both can't be 9, so one is 3 and the other 7. Each possibility gives a solution, the answers being 3023x10x17 = 513910 and 7057x10x13 = 917410."

"Exactly," said Professor Neare. "And that should hold us unless and until Joe finds a word with 3 interior x's, or a literal subtraction in which a hyphen becomes a minus sign. In fact, it will have to hold us while I tell you about a remarkable coincidence last winter on the road around Lake Mixihaxiwunxit.

"A highway maintenance crew was stationed at the south end of the lake. At noon one day after it had been snowing a bit, the big Sno-Glo started out to clear one lane around the lake. By 1:00 pm the track was getting dim, so the medium Sno-Shovo with two-thirds as much capacity was sent out to follow up. An hour later the little Sno-Pusho with half the capacity of Sno-Glo was dispatched to follow the two bigger plows. Still later, by this remarkable coincidence, the snow stopped just as the Sno-Glo completed the circuit, with the Sno-Shovo and the Sno-Pusho just overtaking it. How long did it snow?"

[*Cal Klaters were: Flo Ridan (Charles G. Edson), Rudolph W. Meyer, Uppan Atom (Count Harvey), H. Francis Finch, James R. Bole and C. W. Trigg. The snowplow problem developed from a suggestion by Joseph M. Brandstetter.*]

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DECEASED

John Gordon Turnbull (M. '46), age 62, founder in 1941 and president of J. Gordon Turnbull, Inc., with headquarters in Cleveland, Ohio, died at his Los Angeles (Calif.) home, on April 1. From 1917 to 1938, Mr. Turnbull was chief engineer for Albert Kahn, Inc., Detroit, Mich., and from 1938 to 1941, consulting engineer for General Motors Corp. In recent years he had devoted his work to projects involving the development of aircraft, synthetic rubber, atomic energy and aluminum industries. Earlier Mr. Turnbull worked on design and construction of the automobile industry's largest plants. Projects he was connected with include the Ford Motor Company's River Rouge plant, the Knolls Atomic Laboratory, and the atomic town of Richland, Wash.

J. G. Turnbull

Frank Hart Alcott (A.M. '46), age 62, for 17 years building codes consultant and structural engineer with the National Lumber Manufacturers Association, New York, N.Y., died at his home in Jamaica, N.Y., on March 16. Other lumber trade groups he had been connected with include the Red Cedar Shingle Bureau and the New York Lumber Trade Association. Mr. Alcott was an alumnus of Rensselaer Polytechnic Institute.

Robert Edward Anderson (J.M. '47), age 29, of Alliance, Ohio, died on November 4, 1952. A member of the staff of Virginia Military Institute at the time of his death, Mr. Anderson had graduated from the school in 1947. He was a graduate teaching assistant at Purdue University for a brief period.

Harry Bouchard (M. '40), age 64, for 35 years professor of geodesy and surveying at the University of Michigan College of Engineering and since 1938 director of Camp Davis, the university's engineering camp in Wyoming, died in Washington, D.C., on March 21, while attending a surveying conference. After graduation from the university in 1911 Professor Bouchard served in an engineering capacity with several firms including the J. G. White Engineering Co., the G. S. Williams Co., in Ann Arbor, Mich., and the Georgia and Michigan Central railroads. He was the author of a textbook on surveying.

Thomas Archibald Bedford (M. '10), age 83, associated with the California State Division of Highways from 1911 until his retirement in 1939, died at Redding, Calif., on March 14. Graduating from Southwest University in 1891, Mr. Bedford was county engineer of Knox County, Tex., for ten years and division engineer of the Kansas City, Mexico and Orient Railway for seven years before entering highway work.

Samuel Eric Braswell (M. '51), age 52, of Columbus, Ohio, died in Turkey on April 12, while on assignment for Metcalf, Hamilton, Grove, New York, N.Y. Mr. Braswell was connected with several government agencies during his career, including the U.S. Bureau of Public Roads, Office of the Chief of Engineers, and the Civil Aeronautics Administration. He was an alumnus of the Georgia School of Technology.

Joseph Arthur Carr (M. '40), age 63, who had served continuously for 32 years as engineer and superintendent of the Ridgewood (N.J.) Water Department, died in January. Before entering the department Mr. Carr worked for the Consolidated Water Co., Utica, N.Y.; the Syracuse Division of the New York State Highway Department; and the Bergen Aqueduct Co., Ridgewood.

James Potter Dod (A.M. '49), age 54, land surveyor of Marfa, Tex., died on March 21. In government service for 20 years, Mr. Dod had been with the U.S. Geological Survey, the International Boundary Commission, the Bureau of Public Roads, and the Corps of Engineers. In 1949, after working in the Canal Zone for almost ten years, Mr. Dod engaged in land surveying in west Texas.

Harold Irving Eaton (M. '28), age 64, since 1924 vice-president and treasurer of the Eastern Engineering Co., Atlantic City, N.J., died recently. Following studies at the Massachusetts Institute of Technology, Mr. Eaton worked for the Isthmian Canal Commission; was chief engineer of the Atlantic County Mosquito Extermination Commission; president of Eaton, Brown & Simpson, New York City; and chief engineer of the Island Development Co., Atlantic City.

Howard Nicholas Eavenson (M. '06), age 79, consulting civil and mining engineer, and head of Eavenson & Auchmuty, Pittsburgh, Pa., died on February 16. In private practice since 1920, Mr. Eavenson was previously employed for 18 years as chief engineer by the U.S. Coal & Coke Co., Gary, W. Va. A graduate of Swarthmore, Mr. Eavenson was active in professional affairs and served as director, vice-president and president (1934), of the American Institute of Mining and Metallurgical Engineers.

William Claney Edgar (M. '21), age 66, civil engineer of Pittsburgh, Pa., and an alumnus of the University of Pittsburgh, died at Fort Lauderdale, Fla., on March 22. In private consulting practice since 1924, Mr. Edgar was previously employed by the John F. Casey Co., and the Koppers Co.

Hugh Robert Edwards (M. '16), age 70, since 1945 supervising engineer for the Defense Plant Corp., in Los Angeles, Calif., died recently. Mr. Edwards was chief engineer for the Hammon Engineering Co., San Francisco, for thirteen years, and executive and consulting engineer for the Anglo-Oriental and General Investment Trust in London, England. After his retirement from the latter firm in 1940, Mr. Edwards maintained a private consulting practice in Los Angeles for several years. He was a graduate of the University of Nebraska.

Isaac Elnatan (A.M. '46), age 58, chief of the soil mechanics and foundations section, Ministry of Agriculture at Tel Aviv, Israel, died on February 1. After graduating from the Technische Hochschule, in Berlin, Mr. Elnatan worked for V. Kuhn & Haber-Shaim of that city. In Israel he had been connected with several Tel Aviv architects, the Water Research Bureau of the Jewish Agency for Palestine, and the Jewish National Fund, Ltd.

John Henry Feigel (A.M. '13), age 71, consulting engineer of Buffalo, N.Y., died several months ago. For more than 22 years Mr. Feigel served continuously as assistant city engineer for the City of Buffalo, retiring in 1943. He graduated from the University of Pennsylvania in 1906.

Louis Grossman (M. '51), age 53, assistant civil engineer for the New York City Board of Water Supply on the Neversink Dam project at Grahamsville, N.Y., died on October 28. In the New York City municipal service for a number of years, Mr. Grossman had worked for the Board of Transportation and the Triborough Bridge Authority. He had also been with the Bureau of Ships in Washington, D.C., and the structural design and materials testing branch of the U.S. Army, in Japan. He had received degrees from New York University and Brooklyn Polytechnic Institute.

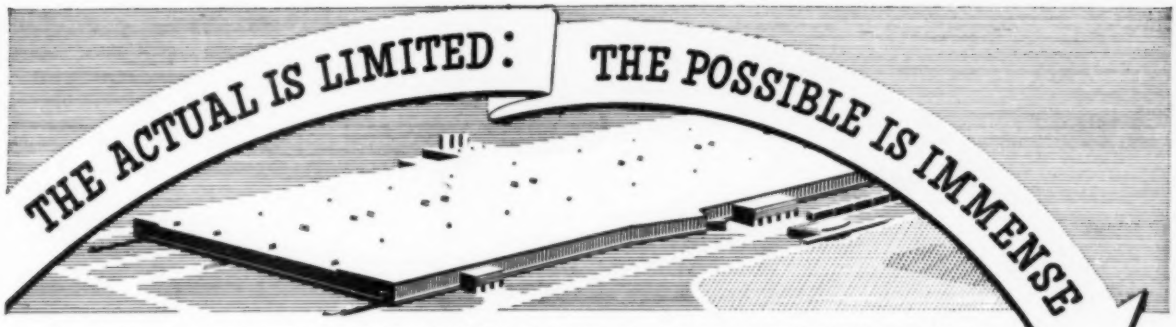
Clarence Albert Hamlin (M. '43), age 56, since 1919 a member of the Illinois Division of Highways, was fatally stricken in his office in Springfield, Ill., on March 2. At the time of his death he held the position of assistant engineer in charge of the office of the Bureau of Construction. Mr. Hamlin was a graduate of Norwich University, and a veteran of both World War I and II.

Joseph William Jones (M. '41), age 56, senior assistant engineer for the Baltimore and Ohio Railroad, in Baltimore, Md., died at his home in Towson on March 10. Entering the B & O service as a chainman in 1917, Mr. Jones advanced to regional engineer in 1946 and senior assistant engineer in 1952.

Harold Augustus Kemp (M. '42), age 58, director of the Sanitary Engineering Department for the Government of the District of Columbia, died in Washington, D.C., on February 16. Mr. Kemp had held assignments in the Corps of Engineers in the Chicago, St. Paul and New York districts, and in the Office of the Chief of Engineers at Washington. He was active in the Potomac River anti-pollution campaign and had been chairman of the Interstate Commission on the Potomac River Basin.

Edwin Harry Loeffler (J.M. '50), age 32, lieutenant, U.S. Army, was killed in an airplane accident on November 22, while en route to Alaska. A 1950 graduate of the University of Utah, Mr. Loeffler had been connected with the Colorado Fuel & Iron Corp., of Denver, Colo., as a sales engineer before he was called to duty.

(*Continued on page 82*)



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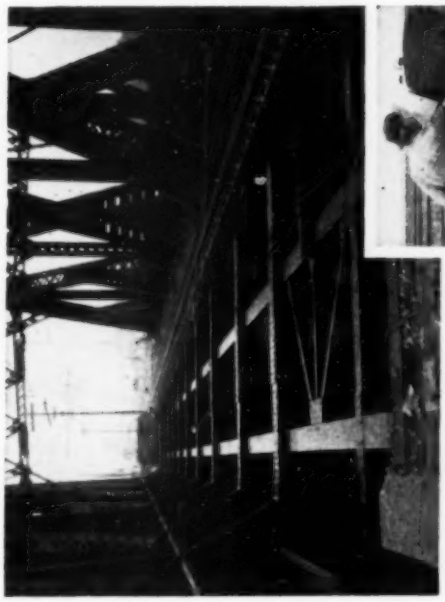
LINCOLN WELDING SPEEDS BRIDGE REPAIRS

...helps maintain Rapid Transit schedules

By **Paul K. Jones,**
Director of Transportation
Shaker Heights Rapid Transit
Shaker Heights, Ohio

BY taking advantage of arc welding in simplifying repairs, it was possible recently to save considerable time in the reinforcing of a bridge on the Shaker Heights Rapid Transit right-of-way. Cross braces that had been weakened by rusting had to be replaced with heavier members of angle iron. As this work required removal of right-of-way track, it was imperative that every effort be explored to eliminate delay in getting the track replaced. Arc welding achieved this result in addition to eliminating rivets thus making the bridge easier to paint to lower future maintenance costs.



▲ **Fig. 3. Double track right-of-way** *on Shaker Heights Rapid Transit System. Weakened cross braces were replaced in minimum time with arc welding.*

Fig. 4. Lincoln 200amp "Shield-Arc" ▶ *engine driven welder used for faster, easier replacement of cross braces.*

SIMPLIFIES BRIDGE REPAIRS

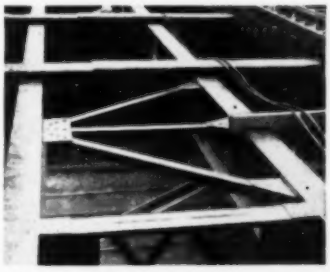


Fig. 1. Rusted-out Braces *originally riveted to flanges of bridge girders are cut out quickly with torch.*

CUTS DOWNTIME

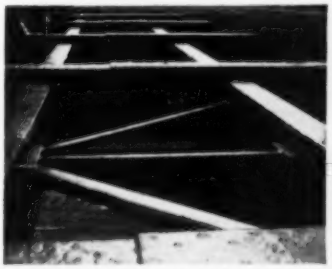


Fig. 2. Faster Construction. *Angles sawed to length are fillet welded to web of girder with Lincoln "Fleetweld 5" type electrode.*

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Henry Edwards Mecredy (M. '36), age 69, civil engineer with the Virginia Department of Highways at Salem, Va., died on March 5. Mr. Mecredy had been with E. I. du Pont de Nemours; the Virginia Bridge & Iron Co., at Roanoke; and the Roanoke Chamber of Commerce. He had also served as district engineer and field representative for the Emergency Relief Administration and the Works Progress Administration, at Roanoke. He graduated from the Virginia Military Institute in 1906.

Robert Collyer Noerr (A.M. '07), age 79, retired engineer of Hartford, Conn., died in that city on March 10. In 1910 Mr. Noerr established a consulting partnership with the late Albert H. Greenwood, retiring from active participation in 1939. He was an alumnus of Lehigh University, class of 1897.

John Castlereagh Parker (M. '12), age 73, retired vice-president of the Consolidated Edison Co. of New York, Inc., and former president of the American Institute of Electrical Engineers, died in Brooklyn, N.Y., on March 23. Mr. Parker had been connected with the Ontario Power Co., the Niagara, Lockport and Ontario Power Co., and the Rochester Railway and Light Co., and for several years was president of the Brooklyn Edison Co. From 1915 to 1922 Mr. Parker was professor of electrical engineering at his alma mater, the University of Michigan.

Henry Abbett Pulliam (A.M. '23), age 58, research engineer devoted to investigation of the problems of government, died on December 19. Associated for many years with research agencies in Albany and Schenectady, N.Y., Mr. Pulliam was president of the Government Management Research Inc., Schenectady, at the time of his death. Earlier he had been chief engineer of the Board of Drainage Commissioners of McCracken County, Kentucky, and commissioner of public works and chief engineer for the City of Paducah, Ky. He was an alumnus of McLean College.

William Henry Robinson (M. '20), age 74, former city engineer (1926–1946) and city auditor (1935–1946) for Williston, N. Dak., died in that city on February 13. Mr. Robinson, who retired in 1946, had served earlier as chief engineer, state engineer and secretary of the North Dakota State Highway Commission. He graduated from the University of North Dakota in 1905 with degrees in mechanical and civil engineering.

Mario Bruno Sibilia (A.M. '26), age 59, for 15 years president and engineer of the Queensboro Iron Works, Inc., Flushing, N.Y., died on June 15, 1952. He first became associated with the firm in 1931, as general manager. For several years, Mr. Sibilia was employed by the New York Central Railroad, and then managed his own business, the De Vita Iron Works in Flushing. He was an alumnus of the Polytechnic Institute of Bologna, Italy.

John Franklin Skinner (M. '06), age 85, retired engineer of Glendale, Calif., and a graduate of Cornell University, died at his home on March 14. For 43 years (1891–1934) Mr. Skinner was a member of the engineering department of the City of Rochester, N.Y., holding the position of assistant city engineer at the time of his re-

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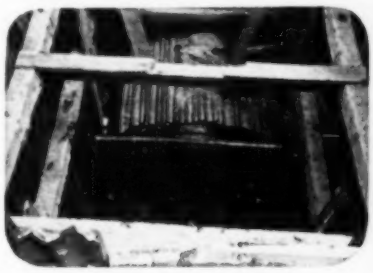
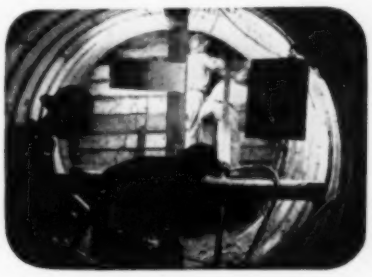
Threading Armco ASBESTOS-BONDED Pipe through Conduit.



Shaft at start of tunnel.



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Both engineers and contractors find that Armco Sewer Structures have many definite advantages. Write for complete data on your specific problem. Armco Drainage & Metal Products, Inc., 1253 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. Export: The Armco International Corporation.

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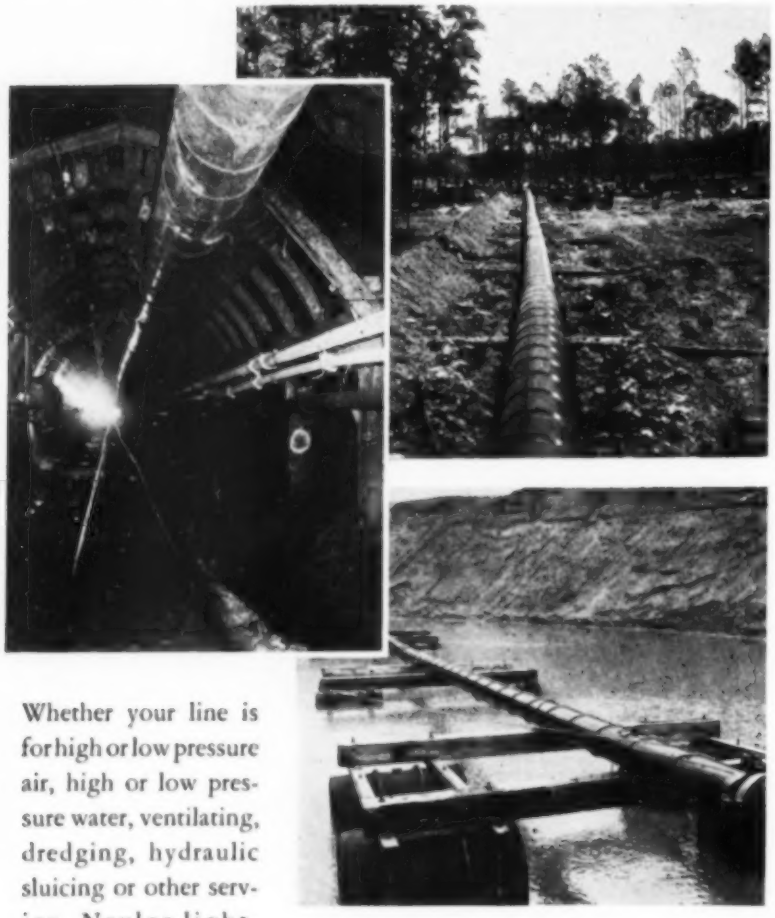

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Naylor Lockseam Spiralweld pipe is easy to handle and install. Naylor Wedge-Lock couplings speed connections, and with Naylor pipe, give you the all-around piping combination for your requirements.

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tirement. He acted simultaneously as consultant to over 15 municipalities and 50 corporations, and during the recent war was consultant to Holmes & Narver of Los Angeles.

Charles Arthur Mockmore (M. '33), age 62, head of the department of civil engineering at Oregon State College, died in Corvallis, Oreg., on April 11. Shortly after graduating from the University of Iowa in 1920, Professor Mockmore joined the staff of Oregon State, which he served continuously until his death. While on sabbatical leave in 1931 he was research associate at the University of Iowa. Professor Mockmore was the author of several papers and books, and was awarded the J. James R. Croes Medal in 1939.

Walter Mickle Smith (M. '06), age 85, consulting engineer of Glenn Springs, S.C., and a graduate of The Citadel, died on March 12. During a 16-year period with the Corps of Engineers, Mr. Smith was employed on the construction on the Panama Canal. Following that he was designing engineer for the New York Board of Water Supply on the Kensico Dam project. From 1919 to 1946 he was with the Illinois Division of Waterways, at various periods acting as chief engineer and consulting engineer.

Oscar Emil Strehlow (M. '04), age 80, since 1944 secretary and treasurer of Walsh and Masterson Inc., foundation contractors of Chicago, Ill., died on February 28. Mr. Strehlow's association with the firm began in 1923 when he served as treasurer and then president for a thirteen-year period. Earlier he was with the U.S. Engineer Department (1894–1904), and James O. Heyworth, of Chicago (1904–1923). Mr. Strehlow was an alumnus of the University of Illinois.

William Everett Swift (M. '10), age 82, retired civil engineer of Cornwall, Conn., whose career embraced preliminary work on the Panama Canal and design of intersections on the New York subway system, died at Harwinton, Conn., where he had been living lately, on February 28. Entering practice in New York City in 1921, Mr. Swift, had been a consultant to the federal government for several years. He graduated from the Massachusetts Institute of Technology in 1895.

Fayette Samuel Warner (A.M. '32), age 58, engineer economist with the Federal Power Commission, Washington, D.C., died on January 23. Connected with the Commission since 1929, Mr. Warner was regional director in Chicago for three years before going to Washington. Earlier he had been associated with Edward J. Cheney of New York City for eight years. Mr. Warner held degrees from Rensselaer Polytechnic Institute, the Wharton School of Finance and Commerce, and the University of Pennsylvania.

Harlow Frank Wetherbee (A.M. '24), age 57, a member of the Yant Construction Co., Omaha, Nebr., since 1931, and vice-president of the firm since 1944, died in Omaha on March 18. He had been with Bruce & Grupe, consulting engineers of Omaha, for ten years. Mr. Wetherbee studied at the University of Nebraska.

James Schulyer Whitney (A.M. '49), age 31, associate partner in the firm of Ammann & Whitney, New York, N.Y., disappeared while swimming off the coast of Nassau, the Bahamas, on March 27. Memorial services were held in Milwaukee, Wis., on April 2. A graduate of Cornell University, Mr. Whitney served in the South Pacific as a Navy lieutenant aboard destroyers during World War II. He had been with Ammann & Whitney since 1946.

George Arnold Wieman (M. '30), age 72, since 1926 member of the firm, Sandlass, Wieman & Associates, of Baltimore, Md., died on December 24. After graduating from the Gross Herzogliche Technische in 1905, Mr. Wieman joined the Chesapeake Iron Works in Baltimore, as a structural draftsman. Later he advanced to chief engineer.

NEWS OF ENGINEERS

Earnest Boyce left New York on March 30 for Java, where he will be a member of a twelve-man session for the World Health Organization (WHO) to study and report on public health problems in Java. An internationally known sanitary engineer, Professor Boyce is the only engineer on the team. He is on a two-month leave from the University of Michigan where he is chairman of the Department of Civil Engineering.

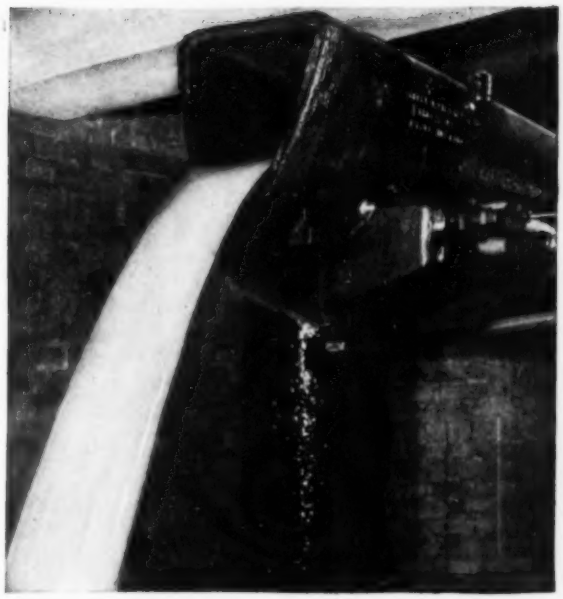
Earnest Boyce

J. E. Atchison, vice-president of the Iron Fireman Manufacturing Co., of Cleveland, Ohio, was recently named president of the Cleveland Society of Professional Engineers.

George J. Brown, formerly in charge of structural engineering with Hydrocarbon Research, Inc., New York City, is now affiliated with the firm of J. Ray McDermott & Co., Inc., in Harvey, La. As chief design engineer, Mr. Brown is in charge of the design of marine structures—particularly offshore drilling in the Gulf of Mexico.

J. Stuart Crandall, consultant with the Crandall Dry Dock Engineers, Inc., Cambridge, Mass., was elected president of the Boston Society of Civil Engineers at its 105th anniversary meeting.

Robert J. Cummins, consulting engineer of Houston, Tex., was recently named



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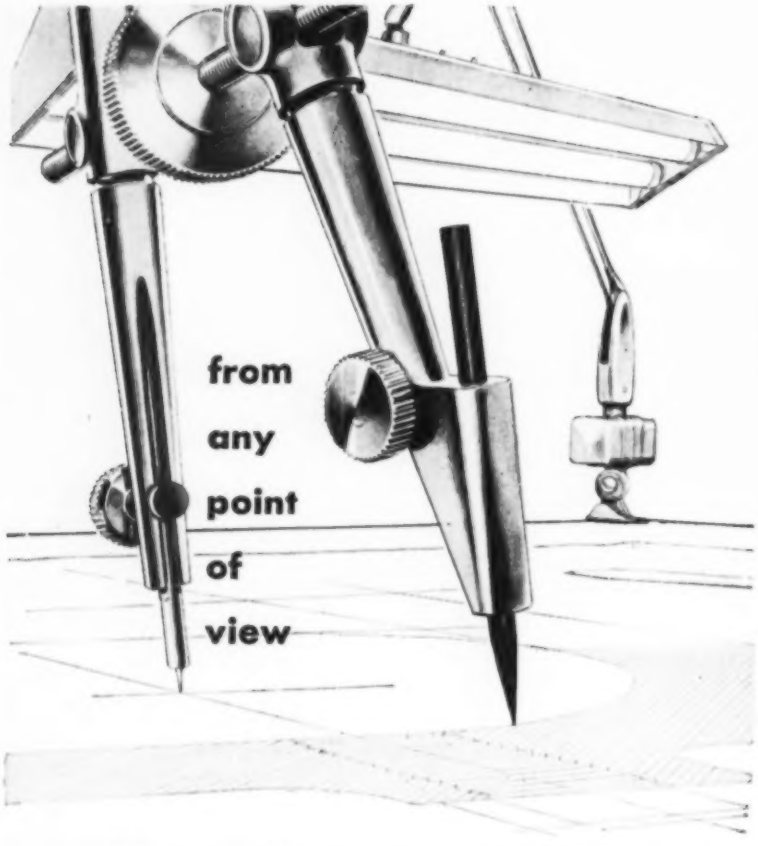

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AMERICA'S STANDARD FOR OVER 30 YEARS

"Engineer of the Year" at a banquet at the Shamrock Hotel in Houston, climaxing the observance of National Engineers' Week.

Hardy Cross, Strathcona Professor of Civil Engineering at Yale University, will retire at the end of the current academic year. A member of the staff and chairman of the department of civil engineering since 1937, Professor Cross previously taught at the University of Illinois, Brown University, and Norfolk Academy. He is widely known as the originator of new methods of structural engineering analysis, including the moment-distribution method of computing stresses in rigid frames, called the "Hardy Cross Method." The many honors accorded him include honorary membership in ASCE and the ASCE Norman Medal.

Hardy Cross

Albert G. H. Dietz professor of structural engineering, at the Massachusetts Institute of Technology, has been appointed acting head of the course in building engineering and construction. Dr. Dietz has been a member of the faculty since 1938. For special work performed during World War II for the Office of Field Service, Office of Scientific Research and Development, while on leave from MIT, he was awarded a certificate of appreciation from the Army and Navy.

Edward W. Digges has been transferred from the Alaska District, Corps of Engineers, where he was serving as assistant chief of the Engineering Division for Utilities, to Headquarters, Tactical Air Command, Langley Field, Virginia, as chief engineer, Tactical Air Command.

Glen Edgar Edgerton was sworn in as a member of the Board of Directors of the Export-Import Bank of Washington on April 7, by the Hon. Fred Vinson, Chief Justice of the Supreme Court. General Edgerton has been chief engineer of the Federal Power Commission, Governor of the Panama Canal Zone, and executive director of President Truman's Commission on the Renovation of the White House.

Richard A. Floyd, city engineer and director of public works for Chula Vista, Calif., was named city manager to succeed **H. V. Bryant,** whose resignation becomes effective June 30. Mr. Floyd has been serving as acting manager.

Paul W. Freitag, Jr., North Jersey field representative of the Industrial Productions Division, Goodyear Tire & Rubber Co., Inc., has been transferred to the company's main office, in Akron, Ohio, as a project engineer in the engineering division of the Belting Sales Dept.

Virgil E. Gunlock, Chicago Commissioner of Public Works, recently received an award

from the Illinois Society of Professional Engineers for outstanding service to the society during his tenure as president in 1951.

David C. Harris has accepted an appointment as professor of civil engineering at the Afghanistan Institute of Technology, Kabul, Afghanistan. The institute has an all-American faculty and an English-speaking student body of about 150. Mr. Harris formerly was in the bridge department of the California State Highway Department.

Roy P. Hart, chief operating officer for the Missouri Pacific Railroad, recently received a Missouri Honor Award for Distinguished Service in Engineering from the University of Missouri. He was cited for "his outstanding achievements in the field of railroad engineering and operation while guiding the course of a great national transportation system. . . ."

H. Lyle Henson has been promoted from chief engineer to vice-president of the Peerless Cement Corp., of Detroit, Mich.

ASCE President **Walter L. Huber** represented the Society on March 23 at ceremonies celebrating the 85th anniversary of the charter of the University of California and the inauguration of **Clark Kerr** as first chancellor at Berkeley. **Harold E. Hedger** represented ASCE at the inauguration of Chancellor **Raymond B. Allen** at the University of California in Los Angeles, on March 20.

Harvey H. Jordan, associate dean of the University of Illinois College of Engineering, who is retiring this summer after 42 years of service, will be honored at a dinner on May 15. Dean Jordan joined the staff of the university in 1911, served as assistant dean from 1917 to 1934, head of the department of general engineering drawing from 1922 to 1949, and has been associate dean since 1934.

Thomas H. MacDonald retired on April 1 as Commissioner of Public Roads, U.S. Bureau of Public Roads, after 34 years as head of the agency. The former commissioner has already begun work on the development of a Transportation Institute for Texas A & M College, in collaboration with the Texas State Highway Department. A pioneer in the highway field and an Honorary Member of ASCE, Mr. MacDonald was saluted by Secretary of Commerce Sinclair Weeks as "Mr. Public Roads."

T. H. MacDonald

Wilfred L. Karrer, construction engineer for the United States Bureau of Reclamation, is now in Israel as irrigation adviser to the United States technical cooperation director in the development of the Israeli national irrigation water supply. Previously Mr. Karrer had been working on the

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Kennewick Division of the Yakima project in Washington.

Leslie W. Mahone announces the availability of his service as a consultant in the field of land surveying. Mr. Mahone is a licensed professional engineer and land surveyor in Iowa and Minnesota and was a member of the faculty of Iowa State College for 15 years.

William V. McMenimen, retiring president of the Raymond Concrete Pile Co., of New York City, has been elected vice-chairman of the board of directors. Mr. McMenimen, who has been with the firm since 1918, became president in 1946. He will continue as chairman of the executive management committee of Construction Management and Engineering Associates of New York and Paris—a combination of three contracting firms formed to manage the Air Force construction program in France.

Kimon Melissinos, civil engineer with the chief coordination office of the Hellenic State Railway, Athens, Greece, has completed a study of railroads in England and France, made possible under a fellowship awarded by the United Nations Technical Assistance Administration.

John A. Miller, head of the technical publications section, General Engineering Laboratory, General Electric Co., Schenectady, N.Y., is the author of a recently published book, *Workshop of Engineers,* which brings out significant facts about the first G.E. laboratory.

Norman R. Moore, Director of District 14, represented ASCE at the celebration of the 50th anniversary of Engineers Week at the University of Missouri, on March 20 and 21. During his visit Mr. Moore addressed the Student Chapter, and was among four engineers who received the degree of the "Knights of St. Patrick summa cum laude."

Elmo R. Morgan, coordinator of cooperative research at the University of Utah for the past 18 months, has been appointed vice-president of the university. During the war Mr. Morgan supervised construction and operation of many Army projects in the Southwest, including the atomic bomb project at Los Alamos. After the war, he served as project manager for the Zia Co., Los Alamos, and manager of the AEC Santa Fe Operations Office.

Howard S. Rappleye, chief of the section of leveling, Division of Geodesy, has retired from the Coast and Geodetic Survey, Washington, D.C., after more than 36 years with the bureau. In 1950 Mr. Rappleye was awarded the Department of Commerce Meritorious Service Award for outstanding service.

George S. Rawlins, executive vice-president of J. N. Pease & Co., Inc., of Charlotte, N.C., is now serving as president of the North Carolina Professional Engineers.

Robert M. Reindollar, of Baltimore, Md., has become associated with Gannett Fleming Corddry and Carpenter, Inc., engineers of Harrisburg, Pa. Mr. Reindollar is newly

elected president of the American Road Builders Association and former chairman of the Maryland State Roads Commission.

John P. Riley has resumed his duties as director of development for the New York City Housing Authority following a two-year leave of absence. During his leave he served as coordinator of construction for the Board of Education, completely reorganizing the activities of the board and initiating more than $100,000,000 in new school construction.

Henry G. Schlitt, formerly bridge engineer, was recently named deputy state engineer of the Nebraska Department of Roads and Irrigation, Lincoln, Nebr. After graduating from the University of Nebraska in 1928, Mr. Schlitt joined the department, serving as assistant bridge engineer from 1930 to 1942 and as bridge engineer since 1942.

A. G. Skelton, division engineer with the Oregon State Highway Department at Portland, Oreg., is the new president of the Northwestern Society of Civil Engineers.

Edward J. Squire, retired head of the civil engineering department and professor of structural engineering at Brooklyn Polytechnic Institute, has been awarded the Cross of Lorraine by the French Order of Chevaliers de la Croix de Lorraine et des Compagnons de la Resistance.

Howard H. Sturdy, director and vice-president of the Contracting Division, Dravo Corp., Pittsburgh, Pa., was recently named president of the Constructors Association of Western Pennsylvania.

Granco Steel Products Company, Granite City, Ill., announces appointment of the following district sales engineers: **Charles E. Eck,** development engineer, has been assigned to Kansas City, Mo.; **Olaf O. Roberts,** assistant engineer, will be at Chicago, Ill.; and **F. Allan Tiarks,** sales engineer, will represent the firm in Dallas, Tex. All were formerly working at the home office in Granite City.

J. A. Van Den Broek, professor of engineering mechanics, University of Michigan, recently participated in the Structural Engineering Lecture Series of the Case Institute of Technology. His address was entitled "My Experience with the Theory and Practice of Limit Design."

J. A. Vincent, a member of the staff of R. G. LeTourneau Inc., since 1948, has been promoted from district sales representative for the southeastern United States to the position of eastern area sales manager.

Wylie B. Wendt has retired as professor of civil engineering at the University of Louisville, with the rank of professor emeritus.

Jesse E. Williams, Colorado district engineer for the Bureau of Public Roads, received a meritorious service award for his work for the organization, at Ankara, Turkey. A second award to a Colorado engineer went to **Clyde E. Learned,** division design engineer, who was cited for his work on the Alcan Highway.

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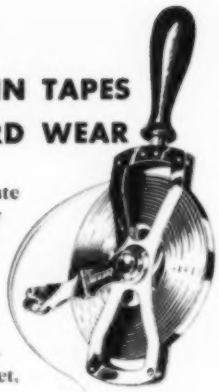

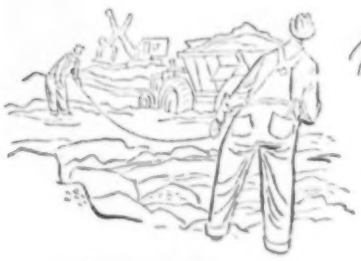

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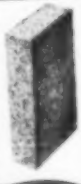

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RECENT BOOKS

Water Supply and Purification

The theories underlying the collection, transportation, delivery, and treatment of water, including the determination of quantity of water available, pipe line calculations, design of distribution systems, and purification processes, are presented in this volume by W. A. Hardenbergh. In addition to the general revision throughout, new material has been added on such developments as fluoridation, and on planning for emergencies and civil defense with the available information on bacteriological and radiological warfare. Actual problems are used for illustrative purposes. (Laurel Publishers, Scranton 9, Pa., third edition, 1952. 516 pp., $6.50.)

Beitrag Zur Berechnung Kreuzweise Gespannter Fahrbahnplatten Im Stahlbrückenbau

In this volume, Gerhard Fischer covers the design of slabs for steel bridge floors, reinforced in two directions. The theoretical section discusses the partly-loaded slab having two free-to-rotate and two supported edges, continuity of slabs and deflection of the edges, with an appendix presenting formulas for orthogonal anisotropic plates. Other sections contain tables, formulas, and numerical examples. (Wilhelm Ernst und Sohn Verlag, Berlin, 1952. 67 pp. DM 10.00.)

Scale Models in Hydraulic Engineering

The aim of the author, J. Allen, is to present the principles which underlie the technique of various hydraulic model experiments, and to provide a critical survey of the present situation, pointing out limitations as well as advantages. The emphasis is on river problems and these are dealt with in great detail with full reference to existing models, mainly British. Special aspects such as the effect of salinity on silt deposition and the construction of tide-generating mechanisms are treated. Extensive references to the technical literature are made throughout the book. Some indication is given as to the scope for further systematic study, particularly of "scale-effects." (Longmans, Green and Company, Inc., 55 Fifth Avenue, New York 3, N.Y., second edition, 1952. 415 pp., $8.)

Foundation Engineering

A unified, logical treatment of all aspects of the subject, with emphasis on the ordinary types of foundations most likely to be met in practice. Part A is a self-contained text on basic soil mechanics. Part B similarly deals with foundation types and construction methods. Part C discusses in detail the problems of selection of foundation type and provides a basis for the structural design of foundation elements dealt with in Part D. A feature of the book is the presentation of specific procedures for exploiting geological information. The authors are Ralph B. Peck, Walter E. Hanson, and Thomas H. Thornburn. (John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, 1953. 410 pp., $6.75.)

Estimating Construction Costs

Students and teachers will welcome this addition to the uncrowded bibliography of construction literature. The author—R. L. Peurifoy, professor of civil engineering at Texas A & M College—describes estimating methods, breaking the estimates into the five components of material, labor, equipment, overhead, and profit for a wide variety of projects. Of particular value to the student are the many illustrative examples. Special attention is paid to the elements of labor, material, and equipment, with charts and tables given for costs and output of equipment and labor. The appendixes

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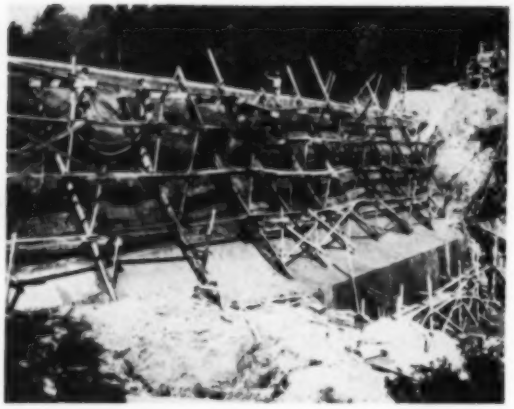

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include tables of base rates for compensation insurance; cost of owning and operating equipment; equipment rental rates; and a depreciation schedule. (McGraw-Hill Book Co., 330 West 42nd St., New York 18, N.Y., 1953. 315 pp., $5.50.)

Acoustics in Modern Building Practice

This introduction to architectural acoustics, gives also a number of examples of practical solutions to acoustical problems, and should prove of interest to engineers as well as architects. Personally associated with this field of research in Denmark, the author, Fritz Ingerslev, here describes the basic principles of acoustics, and then discusses in some detail the transmission of air-borne and solid-borne sound and vibrations and the control of noise in air-conditioning systems. The treatment is more from the practical than the theoretical point of view. (Architectural Press, London; distributed in the U. S. by British Book Centre, 122 East 55th Street, New York 22, N.Y., 1952. 290 pp., $7.50.)

Principles of Aerodynamics

The purpose of this text, by Daniel O. Dommasch, is to describe and define the physical laws that are basic to aerodynamics and the methods used to apply these laws to specific problems. Beginning with the stream function and other basic flow characteristics, the book proceeds with detailed analyses of various types of compressible and incompressible flow, ending with a brief discussion of viscosity effects. Mathematical operations are fully carried out, a chapter on vector operations and the complex variable being provided for those who need it. (Pitman Publishing Corp., 2 West 45th St., New York, N.Y., 1953. 389 pp., $7.50.)

Radioisotopes in Industry

Based on a series of lectures presented at Case Institute of Technology, this book covers all the important industrial uses of radioactive isotopes. The original material has been revised to include the most recent developments. Important related topics are also considered, such as laboratory construction, shielding, personnel protection, handling techniques, and radioactive waste disposal. This is a comprehensive treatment including the recently developed industrial uses of gross fission products. Edited by John R. Bradford. (Reinhold Publishing Corp., 330 West 42nd Street, New York 36, N.Y., 1953. 309 pp., $8.)

Sewerage and Sewage Treatment

Extensive revision (the seventh) of this standard work has been necessitated by developments of the last five years, especially in the fields of stream pollution, recovery of values from industrial wastes, disposal of radioactive wastes, and standards for design of sewerage systems and elements. The comprehensive coverage deals with all aspects from the basic hydraulics of sewers through the most up-to-date sewage-treatment processes, including system planning and construction work. For more effect use the literature references now appearing as footnotes instead of being collected in a bibliographic appendix. The author is Harold E. Babbitt, professor of sanitary engineering at the University of Illinois. (John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N.Y., 1953. 674 pp., $8.)

Library Services

Engineering Societies Library books may be borrowed by mail by ASCE members for a small handling charge. The Library also prepares bibliographies, maintains search and photostat services, and can provide microfilm copies of any items in its collection. Address inquiries to Ralph H. Phelps, Director, Engineering Societies Library, 33 West 39th Street, New York 18, N.Y.

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New Publications

Heat Transfer Conference. Much valuable information in the heat transfer field is made available in the Proceedings of the London Heat Transfer Conference (in September 1951), recently published by the Institution of Mechanical Engineers. American sales of the 500-page, cloth-bound volume will be handled by the American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N.Y. The volume is $10 postpaid. ASCE was one of the cooperating societies in the London Heat Transfer Conference.

Harbor Improvement. The vital role that improved harbors and channels have played in the building of the country and the importance of their further development to the welfare of the United States are stressed in the fifth edition of *Deep Water*, published by the New York Marine News Co., Inc. With less than $5,000,000 and only seven improvements provided for in the 1953 fiscal year (an amount less than 1 percent of the $584,000,000 civil functions appropriation bill), the editors urge further development of waterways on a scale commensurate with the development of other resources. Inquiries concerning the 117-page illustrated publication should be addressed to the New York Marine News Co., Inc., 26 Water Street, New York, N.Y.

Structural Engineering. Issuance of two reprints (Nos. 5 and 6) from bulletins of the American Railway Engineering Association is announced by the Purdue University Engineering Experiment Station. Reprint No. 5, detailing the behavior of floor-beam hangers, is based on static stress measurements on the A.T. & S.F. Bridge near Ponca City, Okla., and is written by M. B. Scott and J. W. Cox. Reprint No. 6 deals with analytical and experimental studies, in five parts, of stress distribution in bridge frames, including rigid-frame analysis for members of variable moment of inertia, directed especially toward floor-beam hanger frames and counterweight trusses. The authors are L. T. Wyly, M. B. Scott, J. W. Cox, K. H. Lenzen, and W. J. Grady, Jr., of Purdue, and E. J. Ruble, of the Association of American Railroads Research Office. A limited number of free copies may be obtained from the Engineering Experiment Station, Purdue University, Lafayette, Ind.

Bridge Loading. Six papers on distribution of load stresses in highway bridges—sponsored by the Highway Research Board's Committee on Bridges and presented at the organization's 31st annual meeting—have been issued by the Board as Research Report 14-B. Copies of the 85-page publication may be purchased at $1.50 each from the Highway Research Board, 2101 Constitution Avenue, Washington 25, D.C.

California Highways. A digest of highway engineering and fiscal studies, prepared for the California Legislature and entitled *California's Growing Traffic Problem*, is available from the State Division of Highways at Sacramento. The engineering survey was made for the state by the Automotive Safety Foundation in cooperation with the Division of Highways and the U.S. Bureau of Public Roads, and the separate financial study by Richard M. Zettel.

Concrete Research. An investigation of field methods for determining air content of mass concrete—conducted at Clark Hill Dam for the Office of the Chief of Engineers by the Waterways Experiment Station—has been made available as Technical Memorandum No. 6-352. Copies, priced at $1 each, are obtainable from the Waterways Experiment Station, Vicksburg, Miss.

Manpower Utilization. Availability of the complete proceedings of the Conference on Manpower Utilization and National Security—sponsored by the Engineering Manpower Commission of Engineers Joint Council in cooperation with the Western Society of Engineers and held in Chicago on September 7, 1952—is announced by EJC. Requests for copies, which are $1 each, should be addressed to the Engineering Manpower Commission of EJC, 29 West 39th Street, New York 18, N.Y.

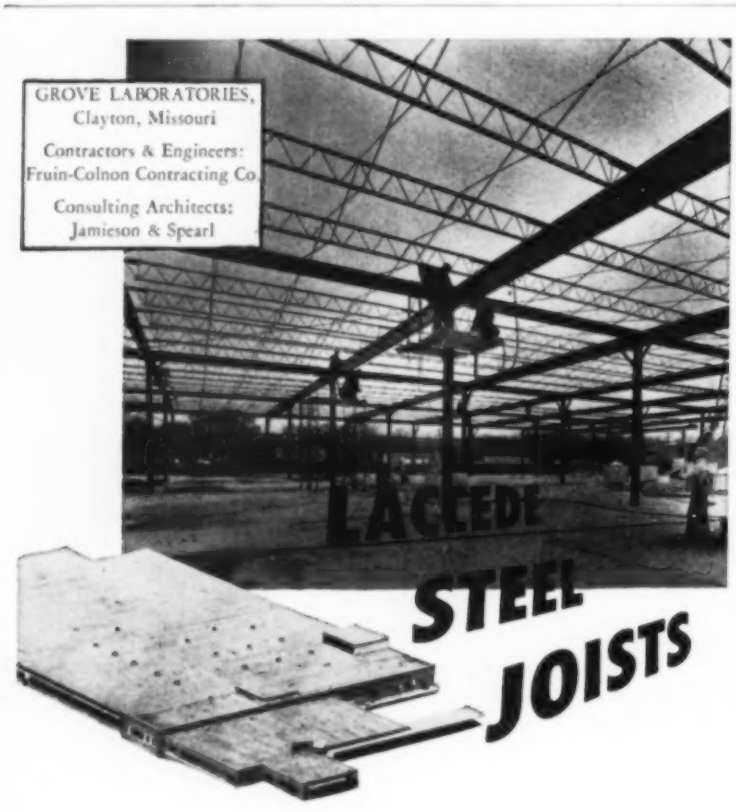
Construction Equipment. Eight articles discussing the "Use and Application of Power Cranes and Shovels" have been compiled under one cover by the Koehring Co., and made available for general distribution. The articles were written by E. O. Martinson, vice-president in charge of engineering, and appeared serially in *Construction Methods and Equipment*. The 32-page booklet may be obtained from Koehring distributors or directly from the company at 3026 West Concordia Avenue, Milwaukee 16, Wis.

Soil Stabilization. Almost every phase of soil stabilization is discussed in the recently issued Proceedings of the Soil Stabilization Conference, held at Massachusetts Institute of Technology in the summer of 1952. The 311-page publication, containing 29 papers and 20 discussions, treats of theoretical aspects, field mixing, practical applications, and economics of each method. Both the common methods of stabilization, such as lime, calcium chloride, sodium silicate, Portland cement, bituminous compaction, drainage and riprap, and the less common methods involving chemicals, electricity, etc., are covered. The incorporation of additives with soil is also described, along with currently available mixing equipment. Requests for the Proceedings, which sells for $4 postpaid, should be sent to Dr. T. William Lambe, Room 1-339, Massachusetts Institute of Technology, Cambridge, Mass.

Earthquake and Blast Engineering. Considerable information about the design of structures for dynamic loads, not available in published form elsewhere, is included in the *Proceedings of the Symposium on Earthquake and Blast Effects on Structures*. Sponsored by the Earthquake Engineering Research Institute and the University of California, the symposium was held in Los Angeles, in June 1952. Copies of the proceedings may be obtained by writing to Ray W. Clough, Secretary, Earthquake Engineering Research Institute, Department of Engineering, University of California, Berkeley 4, Calif. The cost is $5, with a special $3 rate for students.

Structural Engineering. Trends in structural engineering are reviewed in the Proceedings of the Second Illinois Structural Engineering Conference, now available from the publishers, Hutner & Wrought, of Danville, Ill. Subjects covered in the

(*Continued on page 98*)



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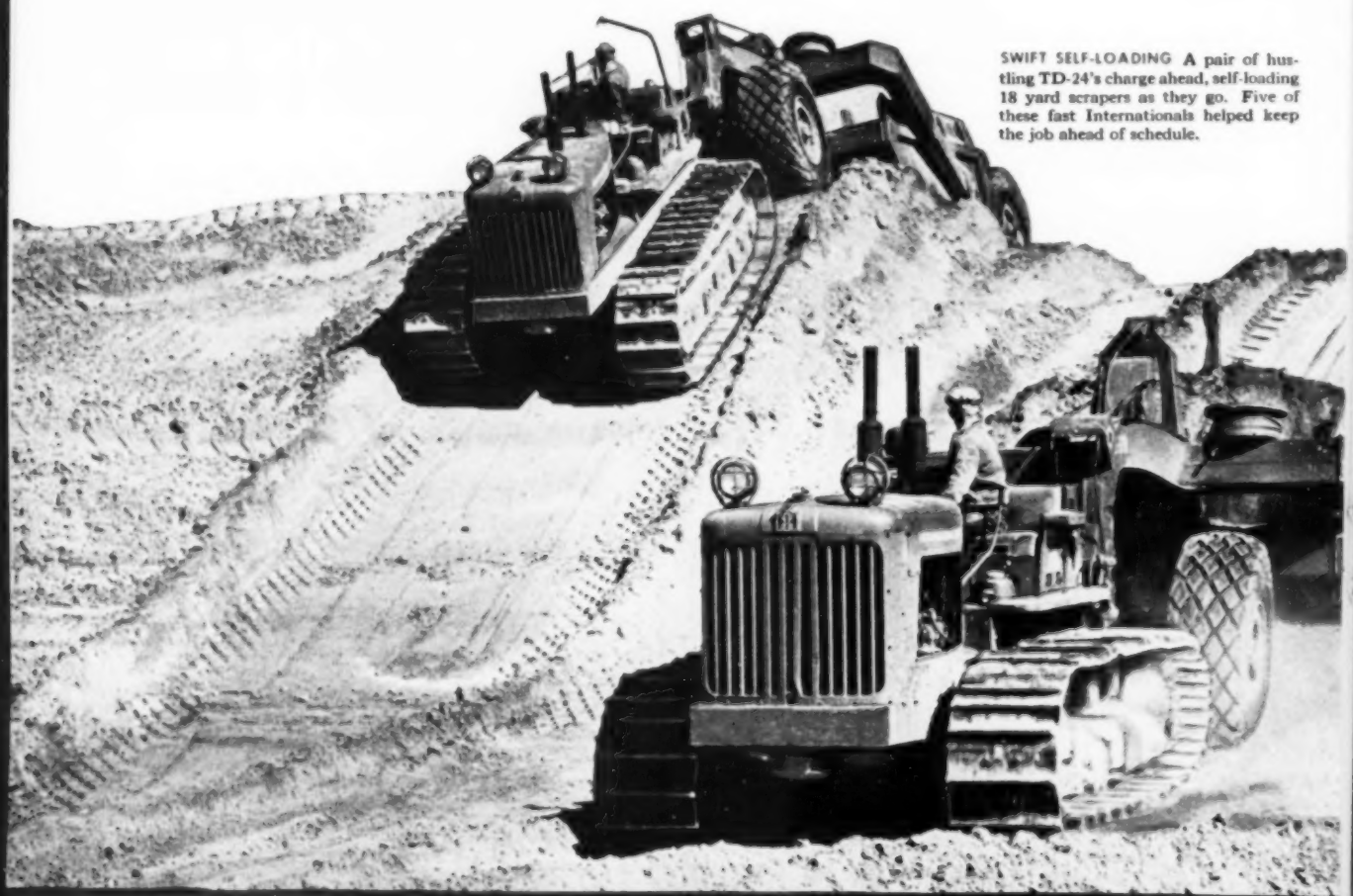
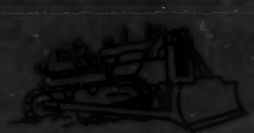


SWIFT SELF-LOADING A pair of hustling TD-24's charge ahead, self-loading 18 yard scrapers as they go. Five of these fast Internationals helped keep the job ahead of schedule.



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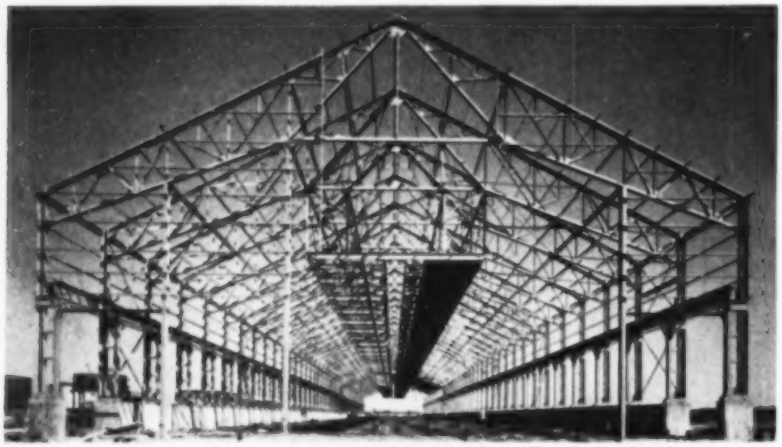
Pollution Control. Data obtained by the San Diego Regional Water Pollution Control Board in investigations to determine the extent, effects, and possible limitations of sewage and industrial waste disposal into San Diego Bay are set forth in a recent report of the Board to the governor. Inquiries concerning the 95-page report should be addressed to the San Diego Regional Water Pollution Control Board, 3441 University Avenue, San Diego 4, Calif.

Salt-Water Encroachment, California. Maps and a report describing the extent of salt-water encroachment in Orange County, California, have been prepared by the U.S. Geological Survey and may be consulted in offices of the Survey in Washington, D.C., and Sacramento and Long Beach, Calif. The data show that even though rainfall was substantially above average in the county for the winter of 1951–1952, salt-water encroachment in ground-water reservoirs continued to spread inland in three areas. Elsewhere the contamination front was essentially static, and in one area it retreated for the first time since the early forties. Prepared by A. A. Garrett, ground-water hydrologist for the Survey, the report is the fourth and last of a series of annual official statements reporting the extent of saline contamination along the Orange County coast.

Urban Hydrology. The hydrologic investigation of urban watersheds, one of several hydrologic research projects currently under study by the Department of Civil Engineering of the University of Illinois, takes the Boneyard Creek Watershed as a sample case. The results of the study are given in a paper, entitled *Hydrologic Studies of Urban Watersheds—Rainfall and Runfall of Boneyard Creek Watershed*, by V. T. Chow, A. M. ASCE, released as the Station's Hydraulic Engineering Series No. 2. Inquiries for copies should be addressed to Prof. J. J. Doland, Department of Civil Engineering, University of Illinois, Urbana, Ill.

Pollution Control. Water quality criteria established by the California State Water Pollution Control Board are reported in SWPCB Publication No. 3. A limited number of copies are available from the Board, 927 Tenth Street, Sacramento 14, Calif., without charge, to government agencies directly concerned with water pollution control. Others may purchase copies from the Documents Section, State Printing Division, 11th and "O" Streets, Sacramento 14, at $3 each postpaid. A 9-cent sales tax must be added for California addresses.

National Bureau of Standards. Scientific and engineering studies conducted by the National Bureau of Standards during the fiscal year 1952 are summarized in the Bureau's annual report for the year, identified as NBS Miscellaneous Publication 207. Copies of the 89-page, illustrated bulletin may be ordered from the Government Printing Office, Washington, D.C., at 30 cents apiece.



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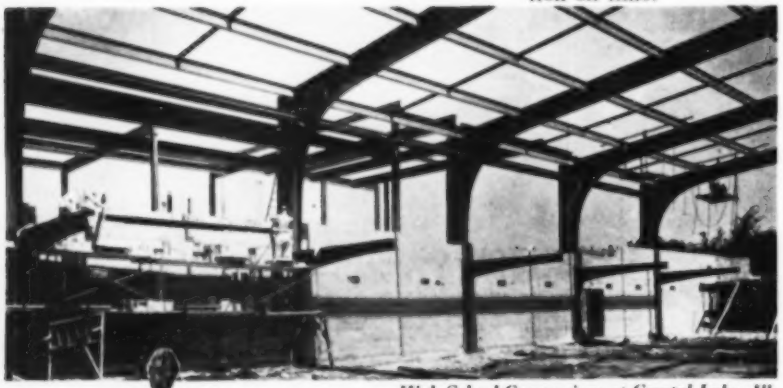

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The University of Florida College of Engineering announces the following fellowships and assistantships for a nine-month period available to graduate students working toward advanced degrees in engineering: Fellowships with stipends of $900 and $1,125; Graduate Assistantships from $1,200 (with one-third the time devoted to teaching or research) to $1,600 (with one-half the time devoted to teaching or research); Teaching and Research Assistantships with salaries based upon education and experience ($4,500 the maximum full-time salary). Applications for the fall session will be accepted until June 1. Address the Dean, College of Engineering, University of Florida, Gainesville, Fla.

A plan to aid industry through fundamental research in engineering and science has been devised at Carnegie Institute of Technology. This plan has two theses: The first is that industrial progress depends heavily upon research; the second, that Carnegie is able to provide new basic knowledge that can be utilized in applied research and development. Carnegie is one of the few technological institutions to inform interested industries as to what its progress has been in fundamental research. A regular and scheduled information service has been set up by the institution.

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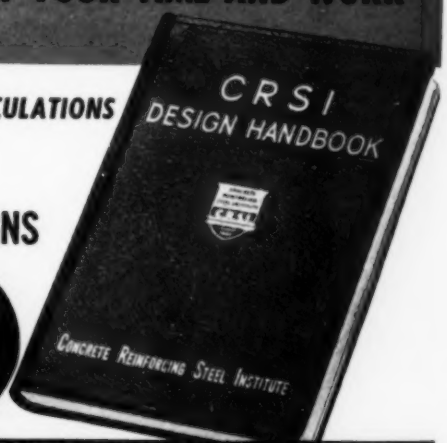

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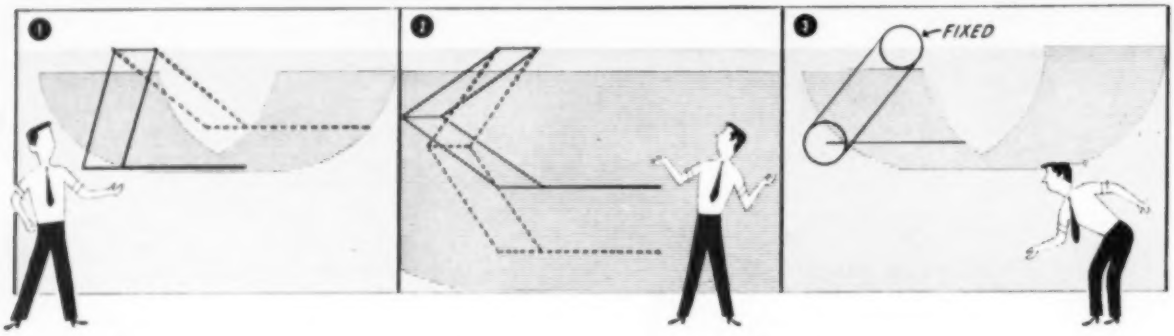

Start with a parallelogram somewhat like this. Visualize one of its short sides anchored to the top of a drawing board parallel to your base line, and let the remaining three sides be free to move together. Add a projecting straightedge to the bottom side as shown, and it will theoretically stay parallel to the base line. Parallel lines could be drawn anywhere within the shaded area above. But clearly, that field of action is too limited.

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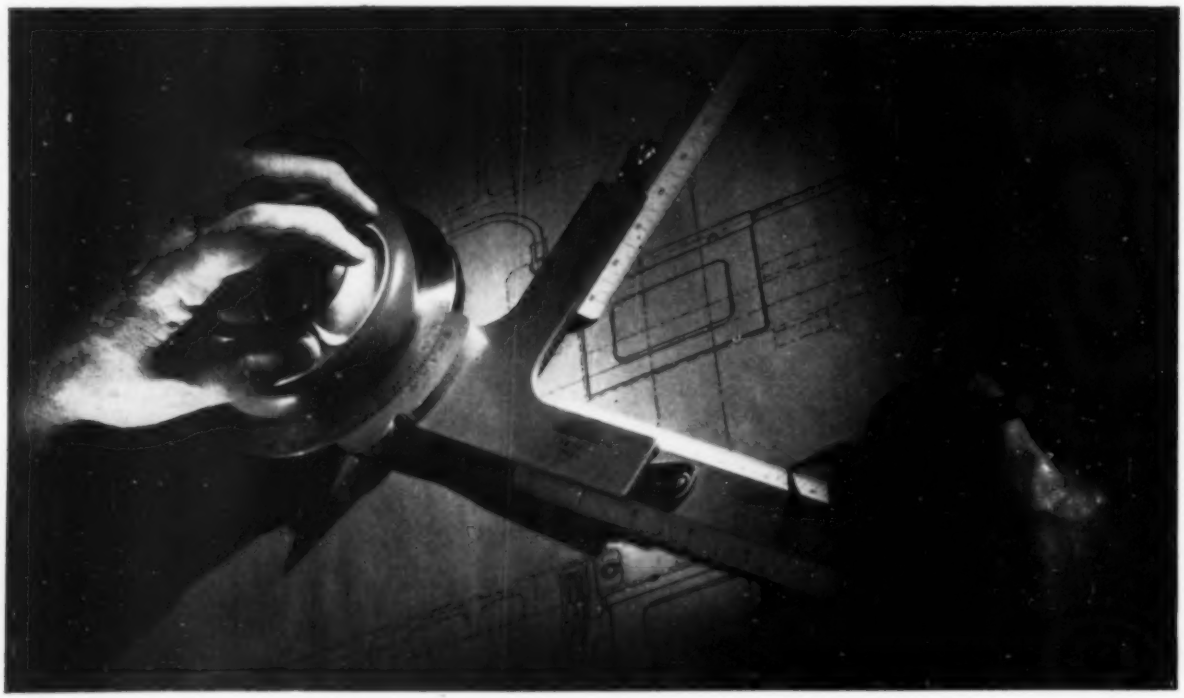

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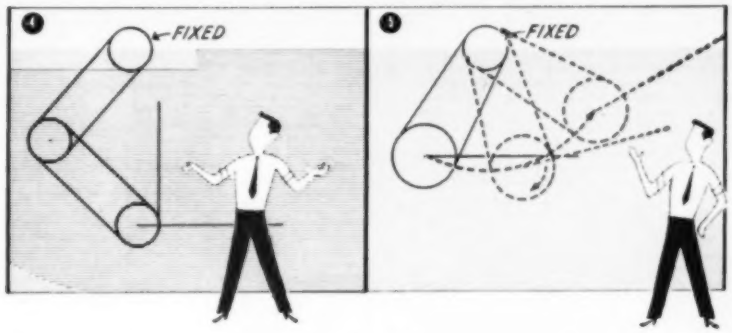
The Right Angle



The band-and-drum machine, with all three drums of precisely equal diameters and with bands which will not slip, will draw absolutely parallel lines over the entire working area. But if the drum diameters are not equal, the parallelogram principle is violated and the machine cannot draw parallel lines. The greater the difference in diameter the more the lines will be out of parallel.

Here, in exaggerated form, is what happens when two of the drums are not equal in diameter. This could occur in either arm of the machine, conceivably in both arms with the errors being additive. From this it is clear that a central factor in the accuracy of a drafting machine is the accuracy of all drum diameters. That is why K&E goes to very extraordinary lengths in this regard in building PARAGON Drafting Machines.

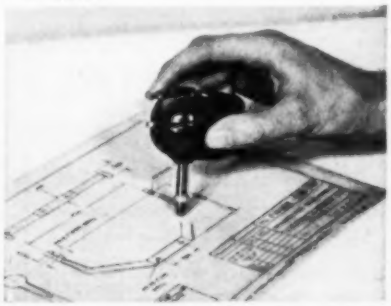
These basic principles and the advanced engineering design in the PARAGON combine to give you the finest in drafting machines. You realize this as soon as you place your hand on the controls.

The scales rotate freely with the lightest pressure on the protractor control ring. Release it and they are locked at the nearest 15° position. Intermediate angles are easily set.

Another PARAGON feature is the open center construction of the arms. Even when they are twisted by lifting the head of the instrument off the board, it is impossible to disturb the factory-set band tension.

Ask your K&E Distributor or Branch to tell you about other PARAGON features or give you an actual demonstration.

An engineer without a K&E Slide Rule is like a doctor without a stethoscope. It's the badge of the profession . . . with good reason. The first American-made slide rule was a K&E, and generations have known these rules for their precision, readability and velvet-smooth operation. They come in all types.



After you've once used a K&E MOTORASER,† you'd no more go back to hand erasing than you'd take to drawing with your gloves on. With MOTORASER you can either pin-point your objective, or cover a larger area without damage to the drawing surface. Runs on 110 volt 60 cycle AC, or DC with an inexpensive adapter.

†TRADE MARK

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This placement service is available to members of the Four Founder Societies. If placed as a result of these listings, the applicant agrees to pay a fee at rates listed by the service. These rates—established to maintain an efficient non-profit personnel service—are available upon request. The same rule for payment of fees applies to registrants who advertise in these columns. All replies should be addressed to the key numbers indicated and mailed to the New York Office. Please enclose six cents in postage to cover cost of mailing and return of application. A weekly bulletin of engineering positions open is available to members of the cooperating societies at a subscription rate of $3.50 per quarter or $12 per annum, payable in advance.

Men Available

CIVIL ENGINEER; J. M. ASCE; B.S. in civil engineering, 1949; 35; married; registered civil engineer in Louisiana; 18 months' experience in construction of reinforced concrete bridge with railroad; 2 ½ years' experience with railroad in design and layout of track and drainage facilities, right-of-way matters. Prefers job in construction or in design work; Texas or Louisiana preferred. C-836.

INSTALLATIONS ENGINEER; J. M. ASCE; 29; married; graduate civil engineer with major in structures. Experienced in managing large engineering and construction organization. Responsible position desired in company with diversified interests; particularly interested in selling or construction. Available July 1. C-837.

CIVIL ENGINEER; J. M. ASCE; 32; married; B.S. in forestry and C.E., M.S. in C.E., major in highways, minor in logging; registered; 1 year's timber access road location; 2 years' design superintendent and 1 year's construction management on airfield construction; 16 months' construction contract administration on large industrial projects. Desires position in western United States, Canada or Alaska. Available June 1. C-838.

CIVIL ENGINEER; J. M. ASCE; 28; married; B.S. in C.E.; registered in Oregon; 2 years' experience with state road location; design and construction; 1 year's experience in bridge construction inspection. Desires employment with consultant firm. Location preferred, Northwest or foreign. C-839-533-A-7 San Francisco.

FOUNDATION AND STRUCTURAL ENGINEER; J. M. ASCE; B.S. in C.E., 1951; Tau Beta Pi; age 25; 2 years' experience teaching and research (applied mechanics, indeterminate structures, soils); also in land surveying, and drainage, foundation, reinforced concrete and highway design. Desires permanent design and/or research position; location open; available summer 1953. C-840.

CIVIL ENGINEER; A. M. ASCE; age 41; project engineer for 15 years on heavy construction from location and planning time through asphaltic pavement state; 3 years' party chief laying out buildings, railroads, streets and piers; also some triangulation for sounding boats and for radar instrument checkers and calibrators. Speaks Spanish fluently; will go to Latin or South America; has spent 35 years in altitudes between 7000 ft and 10,000 ft. C-841.

CIVIL ENGINEER; J. M. ASCE; J. M. AIME; B.S. in C.E.; 23; single; 2 years' general engineering experience for mining company; 1½ years' experience as officer in Corps of Engineers. Prefers construction, structural or mining work. Will consider any location, preferably foreign, and will travel. C-842-604-Chicago.

Positions Available

INSTRUCTORS young, B. S. degree in civil engineering; excellent opportunity for part-time research in highway engineering. Opportunity to pursue graduate work. Must be United States citizens. Salaries open. Location, West. Y-8156.

FIELD ENGINEER, 26-35, civil graduate, with bituminous paving experience, for sales and construction supervision of rubberized bituminous pavements, covering special work on roads and airports. Some traveling. Salary, $5,000-$6,000 a year. Headquarters, New York Metropolitan area. Y-8215.

RESIDENT ENGINEER, 27-32, graduate in civil engineering or building construction engineering preferred, with at least 2 years' of active work in the construction field, preferably on industrial plants. Salary open. Location, upstate New York. Y-8226.

ASSISTANT PROFESSOR, degree in civil engineering, young, with teaching experience, to serve under the department head. Position starts fall, 1953. Salary, $4,000 a year. Location, East. Y-8240.

MAINTENANCE AND CONSTRUCTION ENGINEER, 35-45, mechanical graduate, with institutional maintenance, construction and alteration expe-

STRUCTURAL
DESIGNERS & DETAILERS

Positions available for men with several years' experience in bridges, industrial buildings, or pressure vessels and heavy ducting. Prefer CE or Arch. E. Will consider recent graduates with good educational background in structural analysis.

Unusual engineering opportunities exist in our well established firm in connection with the design of a variety of engineering projects which include bridges, industrial buildings, advanced aeronautical test facilities and other construction.

Please write fully to

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SENIOR
STRUCTURAL ENGINEER

Age 35-45. Degree required. Minimum ten years' experience in design of bridges and heavy reinforced concrete structures. Previous experience in supervisory position essential.

STRUCTURAL DESIGNERS

Age 30-40. Degree required. Minimum six years' experience design of bridges and heavy reinforced concrete structures.

40-hour week
Paid Vacation
Paid Hospitalization and Insurance Program
Paid Company Retirement Program

Submit complete resume of education and experience, salary requirement, references, and availability date with first letter.

All replies to

Box 222
Civil Engineering
33 West 39th St.
New York 18, N. Y.

DAM ENGINEERS, experienced in the design and construction of earth dams, preferably with a working knowledge of soil mechanics, concrete control, and hydrology for the preparation and review of plans and specifications. Duties will include report writing, field investigations and inspections. Some travel and public relations.

HYDRAULIC ENGINEERS with minimum of three years experience in hydrology and hydraulics of water control structures and waterways.

CONSTRUCTION ENGINEERS. One to supervise concrete control and inspection on channel improvement project involving above 9000 cubic yards of concrete. Field experience in concrete construction required. Two to supervise contract inspection on channel improvement and levee construction projects. Field experience in earth construction required.

LOCATION. Pennsylvania. Give full details of experience, education, age, salary expected and references.

ADDRESS replies to Box 223 Civil Engineering, Publication Office, 33 W. 39th Street, New York, New York.

WANTED:
TRAFFIC ENGINEER

Salary range $550 to $650 a month. Depending upon training and experience beginning salary may be above the minimum. Applicants must be registered professional engineers. Annual increases are automatic. Applicants will be accepted until the needs of the service are filled.

Write Personnel Division, City Hall, Madison 3, Wis.

ESTIMATORS

Young Engineers capable of mechanical estimating for construction of refineries, steam power and similar industrial projects. Must have some field experience.

Considerable weight given to ambition, intelligence and interest in estimating and cost analysis.

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rience, to schedule preventative maintenance, prepare specifications and contracts, plan improvements, etc. Salary, $6,000–$8,000 a year. Location, New York, N.Y. Y-8254.

FIELD ENGINEER, civil or mechanical graduate, with industrial building or heavy construction experience, to give line and grade, check equipment drawings and foundations, do cost work on chemical and refinery construction. Considerable traveling in United States. Salary, $4,200 a year plus $7.50 per diem. Y-8270.

DIRECTOR OF PUBLIC WORKS for street and sewer responsibilities in design, construction and maintenance. Salary open. Location, New England. Y-8292.

ASSISTANT PROFESSORS of civil engineering. Master's degree or higher, and some practical and/or teaching experience. (*a*) One to teach a section in elementary plane surveying, a small group in railroad and highway surveying, and fluid mechanics. (*b*) One to teach a course in design of steel and timber structures and probably a course in indeterminate structures at the master's evel. Location, Texas. Y-8309.

SURVEYING INSTRUCTOR with teaching or surveying experience, to teach at summer camp during the month of June. Salary, $100–$130 a week, plus room and board. Location, southern New York. Y-8312.

FIELD ENGINEER, civil graduate, with experience on line and grade, general layout, quantities covering grading, foundations, buildings, etc., for contractor on government project. Salary, $5,500–$7,500 a year. Location, eastern Maryland. Y-8319.

STRUCTURAL ENGINEER with 10 to 15 years' experience in reinforced concrete and structural steel design for electric utility work. Location, eastern Pennsylvania. Y-8331.

CIVIL ENGINEER, graduate, with 5 years' experience, or more, preferably in municipal field for engineering department. Salary open. Location, New Jersey. Y-8344.

STRUCTURAL DESIGNER "A", 28–45, with 4 years of college specializing in structural engineering and at least 7 years' experience, to produce complete engineered designs of structural steel and concrete for industrial plants, machine pits and foundations, platforms, etc. Design and prepare working drawings from notes and sketches, estimate cost of construction, steel and concrete work. Salary, $5,000–$5,800 a year. Location, New Jersey. Y-8362(*a*).

CIVIL ENGINEER, graduate, with at least 8 years' municipal, county or consulting experience covering topographical layout, streets, sewers, utilities, estimates and legal matters. Must have land surveyor's license for New York State. Salary, $6,000–$7,200 a year. Location, New York, N.Y. Y-8364(*b*).

DISTRICT ENGINEER, 30–45, civil or architectural with major in structural design. Should know theory and design of structural steel and possess personality to engage in sales promotion and public relations work with trade association. Some travel. Salary, $7,200 a year. Location, East or Midwest. Y-8367.

SENIOR CIVIL ENGINEER OR JUNIOR CIVIL ENGINEER. (*a*) Senior Civil Engineer with 4 years' experience in engineering surveys, structural detailing, design and construction of sewers, graduate from recognized school specializing in civil and structural engineering; or combination of experience and education; registered professional engineer in the State of Connecticut; thorough knowledge of the theory and practice of engineering design, construction and surveying, hydraulics, etc. Salary, $4,310–$5,450 a year. (*b*) Junior Civil Engineer with either 1 year's experience in civil engineering work in the field or office and graduate of recognized school specializing in civil and structural engineering; or combination of experience and education, good knowledge of the fundamentals of civil engineering, physics, mathematics, hydraulics, etc. Salary, $3,670–$4,240 a year. Location, Connecticut. Y-8369.

FLOOD CONTROL ENGINEER to formulate, organize and supervise flood control program in San Diego County. Salary, $749 monthly. California registration as civil engineer required. Minimum of 5 years' recent responsible professional engineering experience, including 2 years' in flood control and one year of administrative experience. Y-8408.

CONSTRUCTION ESTIMATOR AND COST CONTROL MAN, thoroughly experienced in quantity takeoffs and estimating and with successful performance record in competitive bidding. Cost control experience required. Background in power plant work, process piping and general industrial construction absolutely essential. Should

(*Continued on page 106*)

Advance with *BOEING* research

At Boeing, facilities like the newly redesigned wind tunnel—the only privately owned trans-sonic tunnel in the country—help engineers get ahead. Here, also to help you, are acoustical, hydraulic, pneumatic, mechanical, electronics, vibration, and physical research laboratories. You may work on such long-term projects as America's first-announced jet transport, supersonic flight and nuclear-powered aircraft research, on guided missiles, or B-47 and B-52 jet bombers.

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Boeing pays you a moving and travel allowance. You can work in either Seattle or Wichita. Both of these cities provide fine fishing, hunting, golf, boating and other recreational facilities—as well as opportunities for specialized advanced training. You'll be proud to say, "I'm a *Boeing* engineer!"

Write today to address below or use coupon.

JOHN C. SANDERS, Staff Engineer—Personnel Dept. S-5
Boeing Airplane Company, Seattle 14, Wash.

Engineering opportunities at Boeing interest me. Please send me further information.

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Address _____

City and State _____

On Miami's Two

Photographs show S.E. 4th Avenue bridge over Miami Canal, in Miami, Florida. This is one of two similar single-leaf skew bascule structures recently completed in the southern city. They are the 2nd and 3rd applications of their type in this country.

Approximately 67 tons of 5' U·S·S I-BEAM-LOK open flooring were used on the two bridges.

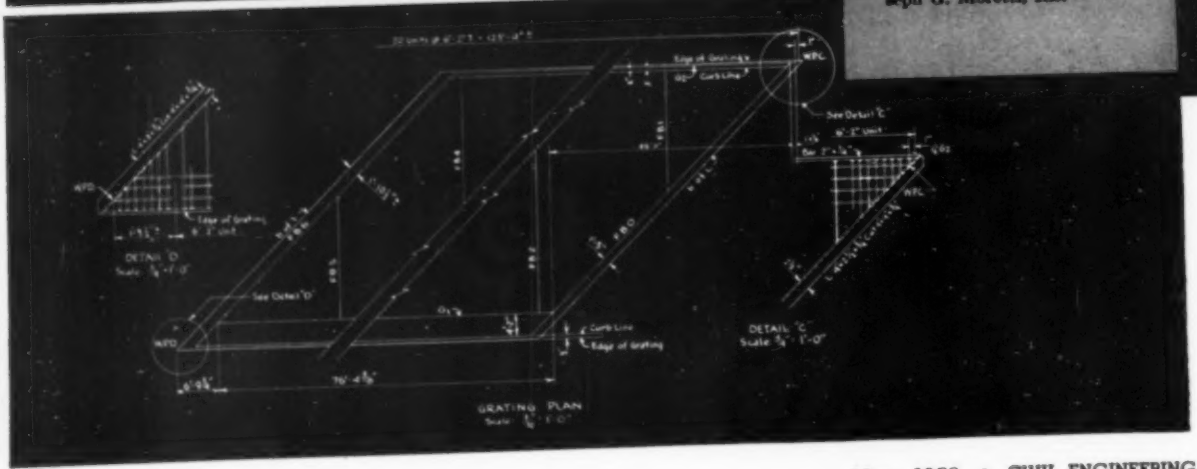
Use of skew single-leaf bascule design, rather than conventional double-leaf square bascule, reduced construction cost $60,000 per bridge.

OWNER: Dade County Board of County Commissioners.

Constructed under the supervision of County Engineer E. A. Anderson, Assistant County Engineer Herbert S. Saffir, Resident Engineer H. C. Thurston.

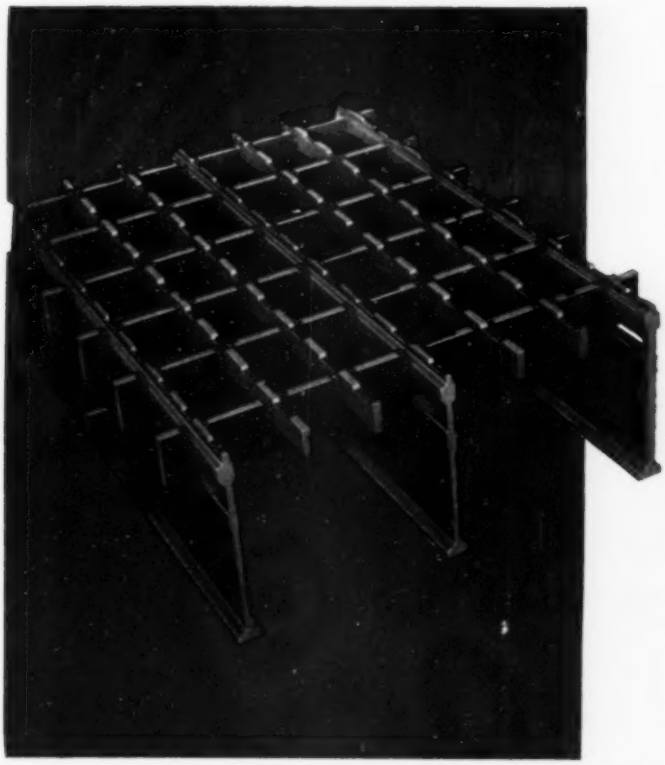
CONSULTING ENGINEERS: Rader Engineering Company, and Hardesty & Hanover.

GENERAL CONTRACTOR: Joseph G. Moretti, Inc.



Skew Bascule Bridges...

U·S·S I-BEAM-LOK saves 272 tons of flooring deadweight



THE two movable bridges recently completed over the Miami Canal at S.E. 4th Avenue and N.W. 36th Street, in Miami, Florida, are the second and third structures of this type in the country.

Both bridges are similar single-leaf bascule structures with 44-ft. roadways. Each crosses the canal at an angle of 45 degrees to maintain a straight alignment for both roads across the water.

The Hanover skew bascule design which exactly fits the channel, eliminated waste span length and offered the least obstruction to navigation. And by avoiding the usual double-leaf type of structure, resulted in substantial savings.

Contributing to this economy was the use of 7,056 sq. ft. of U·S·S I-Beam-Lok open steel flooring.

On the basis that 5″ I-Beam-Lok weighs 18.8 lbs. psf., compared with 96 lbs. psf. for a conventional 8″ slab of concrete, the weight savings on the flooring alone for these two bridges amounted to approximately 272 tons!

Available in units measuring 6′-2″ in width and up to 49′ in length, this lightweight all-steel open flooring with its strong, full 5″ depth can be applied directly to stringer on spans up to 4′ centers to permit H-20 loadings. It does not require secondary supports.

To find out more about U·S·S I-Beam-Lok Open Flooring, contact the sales office nearest you. Our engineers are ready now to discuss its many advantages with you.

U·S·S SHEET PILING ALSO USED ON THESE PROJECTS—Approximately 125 tons of sheet piling were used in the cofferdam construction for the bascule pier and the rest pier on both bridges. 6,340 sq. ft. of sheet piling remained in place on the S.E. 4th Avenue bridge after the piers were completed; and 6,050 sq. ft. remained in place on the N.W. 36th Street bridge.

UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
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UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S I-BEAM-LOK

3-818

UNITED STATES STEEL

The Sauerman Scraper Tower Machine that looms up in the background is completing a basin 1250' long 360' wide and 30' deep which it dug for a sewage treatment plant. The machine loaded the spoil into dump cars for haulage to a fill.

Cut Costs the SAUERMAN Way

In the job pictured above, one of the many different types of Sauerman Scraper Machines shows how to simplify a large excavation job. This mobile unit, operated by one man completes the long, wide excavation all by itself—digging, hauling, lifting and dumping in a continuous, rapid cycle—moving along as fast as required.

Hundreds of other examples of how Sauerman Scraper and Cableway machines have cut costs on various long range material handling jobs—both large and small—are illustrated in the Sauerman Catalog together with specifications of the machines themselves. Write or wire for your copy of this useful catalog NOW.

SAUERMAN BROS., INC.

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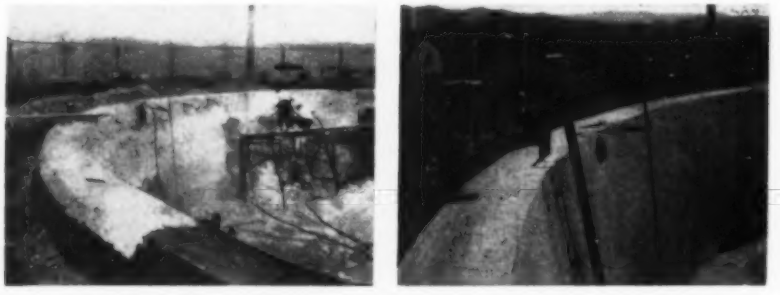

DISINTEGRATED RESERVOIR RESTORED BY CEMENT GUN CO. WITH "GUNITE"

Climatic conditions had ruined the surface of this water storage reservoir at a Central Pennsylvania Institution. Cement Gun Company was called in to restore the structure with "Gunite." Photograph at left, above, shows our crew removing all of the disintegrated concrete prior to covering the wall with wire mesh. With reinforcing in place, "Gunite" was applied to bring the walls up to their original thickness (see photo above, right).

Complete information on many water storage reservoirs constructed or restored by Cement Gun Company are illustrated and described in our latest catalog, together with many other types of "Gunite" work we have done. A request, on your letterhead for catalog C 2400 will bring your copy by return mail.

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"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.
MANUFACTURERS OF THE CEMENT GUN

have been successful as a chief estimator. Location, Pennsylvania. Y-8409.

SPECIALIST in civil engineering to give lectures, organize the setting up of the public works labs, and to advise, if necessary, industrial firms in the country. High level engineering skill required, preferably with teaching and laboratory experience. French or English essential. Location, Syria. Y-8430(*a*).

ESTIMATOR, mechanical or civil graduate, with at least 5 years' chemical plant estimating and construction experience, to prepare complete estimates from flow sheets, covering buildings, process equipment and utilities for chemical manufacturer. Salary, $8,000 a year. Location, New York Metropolitan area. Y-8431.

INSTRUCTOR in civil engineering, young, who is also able to teach mathematics. Must have a master's degree. Location, New England. Y-8436.

CIVIL ENGINEER with over 18 months' experience as project engineer in foreign field office, with at least 25 years' in responsible charge of such work; in good physical condition. Will take responsibility for hydraulic studies and preliminary engineering in new hydroelectric developments; also supervision of maintenance of existing structures. Headquarters, New York, N.Y. Y-8466(*a*).

CONSTRUCTION ENGINEER with at least 3 years' building construction experience in field and office for estimating, alterations and field work with chain store organization. Salary, $5,200 a year. Location, New York, N.Y. Y-8483.

SUPERINTENDENT OF CONSTRUCTION to take charge of a large alteration job on an institutional building. Should have some knowledge of estimating quantities. Position with company may be permanent. Salary, $7,800 a year. Location, New York, N.Y. Y-8491.

DESIGNER, civil engineer, with experience in urban expressway highway design including structures. Should have 2 years' city planning experience. Must be free to travel. Location, St. Louis, Mo. T-9741.

SANITARY AND STRUCTURAL ENGINEER, B.S. in engineering, 35–50, with at least 10 years' experience in sewer systems, sewerage treatment, water supply, treatment, distribution; personnel supervisory experience. Must be licensed structural engineer in State of Illinois. Will be in complete charge of sanitary department. Salary, $10,000–$15,000 a year. Location, Illinois. T-9757.

CONCRETE RESEARCH ENGINEER, civil, to 35, with at least 1 year's experience in concrete making or research work. Will work on highway development problems regarding use of concrete pavement and studying resurfacing with concrete. Salary, to $5,400 a year; employer will pay one half of fee. Traveling. Headquarters, Illinois. R-9793.

CHIEF CIVIL ENGINEER, graduate civil, to 35, 10 or more years' experience. Work will involve general supervision of work of 5 or 6 engineers and a number of draftsmen. Projects include dams, flood control, grading, airports, waterworks, sewers and sewage treatment. Must be able to keep up with modern trends. Salary open. Position with a firm of consultants. Location, Iowa. T-9795.

ASSISTANT OR ASSOCIATE PROFESSOR with M.S. degree in civil engineering, to 45, to teach general civil engineering subjects and structures, teaching experience and experience in industry desirable. Location, Middlewest. T-9805.

Solution to problem on page 44

The employee had willfully violated his instructions and in doing so was undependable. In this case his "hunch", that floors would be added eventually, happened to be right. However, since he had not been instructed or authorized to add to the cost of the original job on the strength of that possibility, he deserved only sensor. Human nature being what it is, he was actually commended.

Non-ASCE Meetings

American Institute of Electrical Engineers. A program covering advances in the electrical field, from tiny transistors to gigantic generators, will feature the summer general meeting of the American Institute of Electrical Engineers to be held at the Chalefont-Haddon Hall, Atlantic City, N. J., June 15–19.

American Society for Engineering Education. The underlying theme of the 1953 annual meeting of the American Society for Engineering Education, to be held at the University of Florida, Gainesville, June 22–26, will be a broad evaluation of the job that the engineering colleges perform.

American Society of Mechanical Engineers. The Oil and Gas Power Division, ASME, will hold its 25th annual conference and exhibit at the Schroeder Hotel, Milwaukee, Wis., May 25–28.

American Welding Society. In conjunction with the spring technical meeting of the American Welding Society, an all-welding exposition will be held at the Shamrock Hotel, Houston, Tex., June 16–19.

Chi Epsilon. A meeting of the New York Alumni Chapter will be held in the Engineering Societies Building, Room 1101, 33 West 39th St., New York City, on June 3, at 7:30 p.m. It will be preceded by an informal dinner in the New York Times Dining Room, 11th floor, 229 West 43rd St., at 6 p.m. There will be no meetings during the months of July and August.

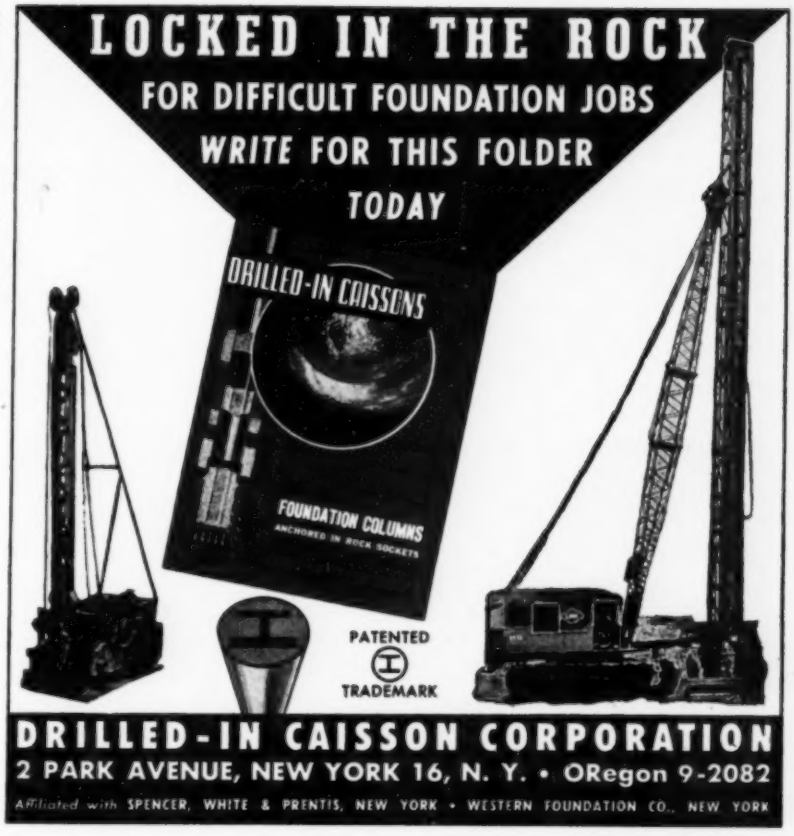
Exposition for Basic Materials and Conference. The first exposition of basic materials for industry, which will take place at Grand Central Palace, New York, N.Y., June 15–19, will be supplemented by a conference on materials at the Hotel Roosevelt, June 16–18.

Conference on Modern Highways. As part of the 1953 summer session of the Massachusetts Institute of Technology, the Departments of Civil and Sanitary Engineering, and City and Regional Planning, and the Massachusetts Department of Public Works, are jointly sponsoring a Conference on Modern Highways on the M.I.T. campus, Cambridge, Mass., June 23–25.

Conference on Soil Stabilization. Examination of current problems in stabilization treatment will be featured at a three-day Conference on Soil Stabilization at the Massachusetts Institute of Technology, June 18–20. Sponsoring the conference with M.I.T. are the Navy Bureau of Yards and Docks; the Army Corps of Engineers; the Highway Research Board; the Massachusetts Department of Public Works; and the U. S. National Council on Soil Mechanics and Foundation Engineering.

Materials Handling Exposition. The Material Handling Institute, an organization of equipment manufacturers, is sponsoring a Materials Handling Exposition, scheduled to take place at Convention Hall, Philadelphia, Pa., May 18–22.

Society of Automotive Engineers. The summer meeting of the Society of Automotive Engineers is scheduled to take place at the Ambassador and Ritz-Carlton hotels in Atlantic City, N. J., June 7–12.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Society for Experimental Stress Analysis. The spring meeting of the Society for Experimetnal Stress Analysis will be held at the Hotel Schroeder, Milwaukee, Wis., May 20–22.

Society of Municipal Engineers of New York. The Society of Municipal Engineers of New York will meet at the Engineering Societies Building, 33 West 39th St., New York, N.Y., on May 27 at 8:15 p.m.

Western Section, Institute of Traffic Engineers. Headquarters for the sixth annual convention of the Western Section of the Institute of Traffic Engineers and the sixth annual Northwest Traffic Engineering Conference will be More Hall on the campus of the University of Washington, Seattle, Wash., May 21–22.

Applications for Admission to ASCE, March 14–April 11

Applying for Member

FREDERICK LAYTON ACKERSON, Atlanta, Ga.
GORDON ALCOTT BEEBE, Rapid City, S. Dak.
THEODORE VICTOR BERRY, Vancouver, B.C., Canada.
PAUL ESTERLY BLUME, New York, N. Y.
HAROLD THOMAS BRADLEY, St. Louis, Mo.
CARLETON CRAIG, Montreal, Canada.
JOHN PETER FERRIS, Cincinnati, Ohio.
LOUIS ARMAND GEUPEL, Arlington, Va.
WALTER SCOTT HARDGROVE, Oakdale, Calif.
THOMAS AUGUSTUS HEATFIELD, Los Angeles, Calif.
GILBERT DENSLOW HENNING, Pensacola, Fla.
MARCUS OLE HILDEN, Columbia Falls, Mont.
HENRI AIME HUFNER, Paris, France.
GOVIND JIVAJI KULKARNI, Ahemedabad, India.
DEMETRIUS JOHN LOUKISSAS, Athens, Greece.
CLIFFORD AUSTIN MEADOWS, Ontario, Canada.
WALTER MARION NETT, Redding, Calif.
WILLIAM JOSEPH NEW, Fort Belvoir, Va.
MAYNARD ADAMS PATTON, Kansas City, Mo.
HOWARD ALLEN PRESTON, Walla Walla, Wash.
PAUL INGOLF RONGVED, New York, N.Y.
RAYMOND WILLIAM RUSS, Fort Worth, Tex.
RICHARDSON SELEE, Balboa Heights, Canal Zone.
WILLIAM SIHLER, Washington, D.C.
PAUL JOSEPH SIMMONS, Arlington, Va.
RALPH ROBERTSON STONE, Decatur, Ga.
HARRISON MOORE TICE, Columbia Falls, Mont.
BARTOW VAN NESS, JR., Baltimore, Md.
JACK EVERETT WEST, Laredo, Tex.
LAWRENCE FRANCIS WHEARTY, Billings, Mont.
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EARL ORLAND BENGRY, Punjab, India.
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WILLIAM ALEXANDER CASTILLE, Los Angeles, Calif.
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HANS ARNOLD GROGG, Vancouver, B.C., Canada.
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FRED JACOB HOPPE, Wauwatosa, Wis.
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MARTIN OREN PATTISON, Houston, Tex.
WALTER RAND, Iowa City, Iowa.
ALLEN MUSCROVE REESE, Toledo, Ohio.
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WILLIAM ERWIN SCHAEM, Cincinnati, Ohio.
KAY ALLEN SPOONER, Benton Harbor, Mich.
JOHN MAC STEWART, Cleveland, Ohio.
WILLIAM CALVIN STILLEY, Juneau, Alaska.
BAILEY TREMPER, Sacramento, Calif.
LAKSHMANASA RAMACHANDRASA VAGALE, Chicago Ill.
EMERSON JOSEPH WAMSLEY, Tampa, Fla.
SAMUEL ALEXANDER WIGON, Boston, Mass.
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RICHARD EDMUNDS WOLFF, Seattle, Wash.

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RAFAEL CORNELIO CORDERO, Lafayette, Ind.
DAVID WILLIAM DUTTWEILER, Ft. Sam Houston, Tex.
CLEMENT FRANCIS EGGER, Kansas City, Mo.
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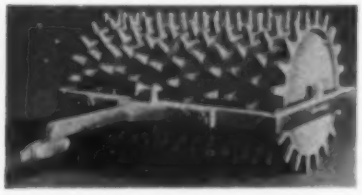
EQUIPMENT, MATERIALS and METHODS

NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

Tamping Roller

AN EXTRA HEAVY duty tamping roller has been announced. The Model 2D10-WS features twin drums with solid wedge-type feet. When loaded with sand it exerts a tamping pressure of 1250 psi. Water ballast may be used for lighter pressures. Like other rollers produced by this company, the wedge-foot model has



Model 2D10-WS

an oscillating yoke which allows a full tamping effect on uneven ground. Drum is 5 ft diameter by 5 ft long. **Southwest Welding & Manufacturing Company, Alhambra, Calif.**

Masonry Saw

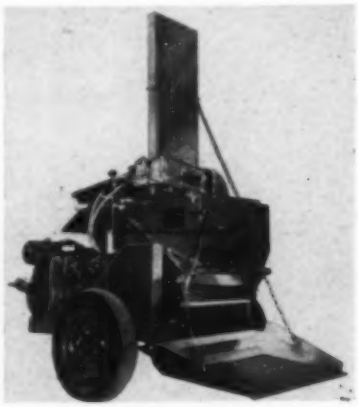
EXCELLENT RESULTS were reported when Gust G. Larson & Sons, Inc., converted their Model HD masonry saw to track sawing of stone lintels on the St. James Cathedral job in Rockford, Illinois. Clipper CBR break resistant blades were used to cut the Indiana limestone. The Model HD masonry saw was converted into a track saw by simply placing the cutting head onto a convertible (4 wheel) car equipped with precision wheel guides—then setting the cart on track. This converted unit without the tracks is also used to cut patches, trenches, or contraction joints in concrete or asphalt. Several exclusive features have been incorporated into the Model HD. A pressure equalizer spring automatically cushions the blade, giving longer blade life and with the patented "select-a-notch" the saw operator can easily adjust the cutting head to any desired height. Other Clipper features are: a factory sealed water pump that operates wet or dry; and a patented hinge—lok-blade guard, which serves as a protective shield and eliminates water spray when wet cutting. Builders and contractors have found that one operator and a new Model HD Clipper can keep a full crew of masons supplied with perfectly cut bricks or blocks. Furthermore, with the dustless Clipper HD, it is possible to operate the saw in confined areas—right alongside the masons. There is no time lost in transporting the material; there is no dust. **Clipper Manufacturing Company, Suite 813, 2800 Warwick, Kansas City 8, Mo.**

Protractor Triangle

AN ADJUSTABLE protractor triangle that permits the drawing of accurate angles from the base line has been introduced. Indispensable to draftsmen, engineers, students and others who require rapid angle measurements, the Tru-Angle can quickly be set to precise graduations of $^1/_2$ deg, then firmly held in place with a knurled knobbed screw. The protractor triangle highlights two rows of everlasting die sunk graduations—the outer row indicating angles from 0° to 45°; the inner row showing angles from 45° to 90° from the shorter base. Skillfully crafted from crystal clear optical plexiglas, the Tru-Angle completely eliminates the blind spots and forms a shatterproof, heat resistant instrument that is impervious to wear, warp and discoloration. **The Alvin Company, Windsor, Conn.**

Asphalt Mixer

THE HTD-B Multi-Pug asphalt mixer, second in the line of portable asphalt mixers being produced by the company, is announced. It is especially suited to hot or cold patching operations in any season under wet or dry conditions. The mixer is



Asphalt Mixer

precisely engineered, rigidly constructed and thoroughly tested in handling on-the-job mixtures of asphaltic concrete, sheet, sand, or mastic asphalt at remarkably high rates. It reactivates and heats stock pile mixture up to 10 tons per hour; prepares cold asphaltic mixtures up to 10 tons per hour; prepares hot asphaltic mixtures up to 5 tons per hour; dries various types of wet aggregates quickly and thoroughly; removes both moisture and solvents from bituminous mixtures; and processes tars, paving asphalts, cut-back asphalts and emulsified asphalt. **K. E. McConnaughay, Lafayette, Ind.**

Scrapers

INTRODUCTION of two high-speed self-propelled Terra Cobra scrapers, the TH-B90 and the TH-B110, has just been announced. Both rubber-tired models incorporate the same basic design and operating characteristics as the larger machines, including positive hydraulic steering, air operated power control, "boiling bowl" loading, positive roll-out ejector

Model TH-B90

and heavy duty construction throughout, with many components interchangeable with the larger models. The units were developed to offer a complete range of capacities to meet varied contractor requirements. Model TH-B90 is equipped with a 150 hp Cummins Diesel engine, and has capacities of 9.0 cu yds struck, 11.0 cu yds heaped. The TH-B110 utilizes a 180 hp Cummins Diesel, and is rated at 11.0 cu yds struck, 13.0 cu yds heaped. All 142 series models are powered by 225 hp Cummins Diesels, and are rated at 14.0 cu yds struck, 17.5 cu yds heaped. Extremely high ground clearance, short turning radius, and ample flotation and traction are said to give the new units a high degree of maneuverability. Simplicity of design and ease of servicing are claimed as outstanding advantages. **Wooldridge Mfg. Co., Sunnyvale, Calif.**

Reflective Curing Paper

RECENT TESTS with all types of concrete curing materials proved the need for a curing medium which would prevent excessive heat on the slab surface as well as retain sufficient moisture during the early period of hydration. As a step in this direction, the Sisalkraft Company has developed a curing blanket. The special reinforced curing paper is bleached white on one side to reflect solar heat—which, when applied to the slab, will bring more into balance these temperature variations. The curing paper will produce the best curing results at the lowest possible per square yard cost. The Sisalkraft blankets will be available in any width up to 26$^1/_2$ ft. Under ordinary job conditions and a 72 hr curing period, the blankets can be re-used a minimum of 15 times. **The Sisalkraft Co., 205 W. Wacker Drive, Chicago 6, Ill.**

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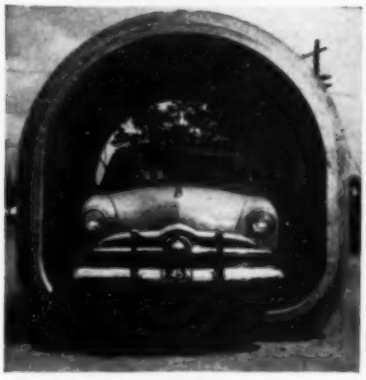

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Equipment, Materials & Methods (Continued)

Loading Attachment

A HIGH-SPEED stockpile loading attachment has been developed for the company's Model 3 Force-Feed Loader. The Force-Feed Loader, the original one on the market, has long been considered the best tool for loading windrowed materials such as found on road maintenance work. The new auger-type feeding mechanism will pour forth a constant stream of free-flowing stockpiled material at volume rates of up to 10 cu yds per min.

Bulldozer Moldboard-Auger Feeder

It is ideally suited for loading such material as coal, gravel, crushed stone, coke, dry chemicals, or any free-flowing stockpiled material. Designated the Bulldozer Moldboard-Auger Feeder, the attachment is available either as original equipment on loaders shipped from the factory or as an attachment which can be installed on machines already in the field. The attachment includes a bulldozer type moldboard which extends across the loader to provide a 90 in. width of gather and has positive hydraulic down pressure on reversible cutting edges. A special feature of the feeder are the side boards at each end of the moldboard. These sideboards may be reversed for loading from windrow or set for loading from stockpile. When set for stockpile loading the sideboards prevent material from building up in front of the front wheels. **Athey Products Corp., 5631 West 65th St., Chicago 38, Ill.**

Control Valve

A PRESSURE REDUCTION valve, known as the automatic liquid level control, has been developed. The valve has been primarily designed to maintain a very low and sensitive outlet pressure. The valve can be adapted to many uses in diverse types of equipment where a steady water or other liquid level is to be maintained automatically. It takes the place of float valves, wherever a closed system is desirable because of sanitary requirements or corrosive conditions. The control operates in a range of inlet pressure from 5 lbs psi to 260 lbs psi and can be set to maintain a steady water level in a range from 5 in. to 20 in. **Helco Products Corp., 2041 Colorado Ave., Santa Monica, Calif.**

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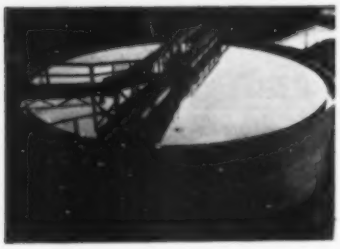

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Equipment, Materials & Methods (Continued)

Concrete Mixer

A feature of a concrete mixer recently announced is the movement of the center of gravity to a point which allows greater payloads while still maintaining legal distribution of the weight on the truck's axles. The big mixer is suitable for mounting on ten-wheel trucks with 175 in. wheelbase. Power for the drum is furnished by a transverse-mounted, 93 hp Ford OHV Industrial 6 and basic

6 To 7¼ Cu Yd Mixer

Ford power transmission assembly. Overall gear ratio through the transmission and final chain drive is 281 to 1. With the engine in the rear, the main weight of the concrete is thrown far forward to equalize axle loads. Construction of the mixer's frame is unusually strong and the drum itself is stiffened by two continuously welded overlapping mixing spirals. Both charging and discharging hoppers are designed with large collecting areas. The folding chute is made of ¼ in. steel and extends 8 ft 6 in. from the swivel center. A 4 ft extension is mounted on the fender. Ninety gal of water are carried in a front mounted combined pedestal and tank with outlets for mixing and washing. A ¾ in. gear-type water pump is driven by V-belt from the mixer engine. Prompt inexpensive maintenance is guaranteed by the usual availability of Ford parts. **Willard Concrete Machinery Sales Co., 11700 Wright Road, Lynwood, Calif.**

Grating Selector

THE COMPANY has made available for the first time in the steel flooring industry, a safety grating selector which with a simple setting enables the user to choose a grating for a specific load-span condition. This selector also will indicate the deflection of grating selected under a given load-span condition. In addition to this, the selector shows a complete table of panel widths in stock sizes as well as a complete range of weights of all A. O. Smith safety grating. The device, which operates similar to a slide-rule, places at the user's finger tips the complete engineering data required for most installation with A. O. Smith safety grating. **A. O. Smith Corp., 3533 N. 27th St., Milwaukee, Wis.**

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SAVES $5,000
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Needless to say, they installed pressure-creosoted posts. No concrete was needed—the posts were set directly in the ground. The link fence, supported by heavy wire was easily attached to the strong, sound wood. They were so pleased with their chain link fence on pressure-creosoted posts that they have installed a similar fence at another plant.

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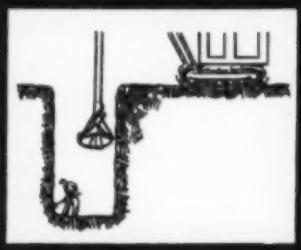

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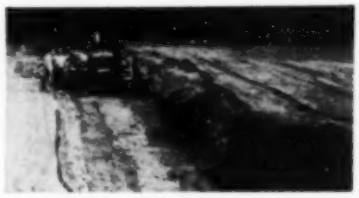
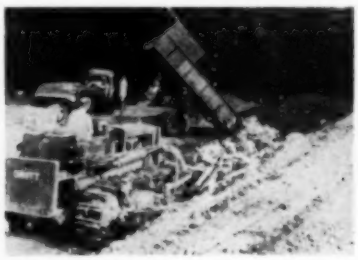
Equipment, Materials & Methods (Continued)

Sanitary Fill Method

ON THE BANKS of the Allegheny River in New York State, the city of Salamanca is constructing a beautiful, park-like area with the Drott Method of Sanitary Fill. For the past two years this community of 9,000 people has used a TD-14A International Tractor with a 2 yd Drott bullclam shovel to dispose of garbage and refuse in this clean, healthy manner. They credit their success in the operation to excellent supervision and a site which has good natural drainage. Here is an excel-



lent example of a well-planned and correctly-built sanitary landfill. The area is being brought up to grade with a series of densely compacted refuse cells sealed beneath two feet of dirt cover. This variation of the Drott Method utilizes a ramp-in-trench operation which is commonly recommended for this type of terrain. To



obtain cover for the compacted refuse, the Bullclam Shovel excavates a shallow trench parallel to finished cells of previous collections. Into this shallow trench, a given amount of the day's garbage is deposited and the Bullclam again begins the cycle of compaction, excavation and cover. Accurate planning and strict operational procedure guarantee a satisfactory fill under almost any conditions. **Drott Manufacturing Corp., Milwaukee 8, Wis.**

Tree Puller

A TREE PULLER is now available that will operate on any tractor with a 3-point hydraulic implement hitch. Called Tree-Grubber, this puller works on the principle of resultant forces. The tractor, with Tree-Grubber attached, backs into a tree and pushes it horizontally. At the same time, the hydraulic lift is operated, which tends to lift the tree vertically. This combination of horizontal push

(*Continued on next page*)

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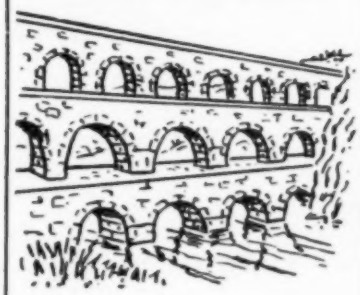

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Equipment, Materials & Methods (Continued)

and vertical lift exerts sufficient diagonal force to push the tree out of the ground at about a 45 deg angle. Removing trees with the Tree-Grubber is a safe, one man operation. Due to its diagonally pushing action, it forces the tree out of the ground away from the operator. This eliminates the danger of the tree falling on the operator, as can happen when a tree is pulled out with tongs or log chain, or when a saw is used. Also, one man with a Tree-Grubber can remove trees faster than two men with less modern methods. **The Continental Mfg. Co., Box 983, Kiligore, Tex.**

Shaft Mucker

A LARGER, $^1/_2$ cu yd capacity model of the hydraulically operated Hydromucker, was announced. The shaft mucker features all of the job proved advantages of its $^3/_4$ yd predecessor in addition to the larger capacity clamshell bucket. Both models are chain slung, low headroom buckets which operate effectively in as little as 7 ft of headroom. The heavy-duty, 2,025 lb $^1/_2$ yd bucket has alloy steel lips and teeth and is closed by two single acting hydraulic rams mounted horizontally within the bucket yoke. Hydraulic power from two 6-cylinder axial style piston pumps each delivering pressures up to 3,500 psi, provides maximum closing pressure at the teeth causing the bucket to bite down into the muck rather than draw away during closing like rope reeved buckets which must be hoisted to close. The sturdy, compact power unit, for use with either the $^3/_4$ or $^1/_2$ yd bucket, is skid mounted and equipped with a lifting eye for easy handling. The 15 hp splash proof motor is equipped with a rain tight starting switch. Power to pumps is transferred through adjustable V-belts. **Bucyrus-Erie Co., South Milwaukee, Wis.**

Asphalt Plants

AN IMPROVEMENT on the Continuflo line of asphalt plants is offered. Recently announced was the design and installation of a new type truck loading hopper with twin clam gates on the mixer units of both the Models 51 and 101 continuous process plants. The hopper permits discharge of material from the pugmill into trucks with least possible segregation of mix. The gates are steam-cylinder actuated by means of a lever extending up to the operator's platform. Capacities of the discharge hoppers have also been increased. The hopper on the small mixer now holds over a ton of material, whereas the hopper on the large mixer holds approximately two tons. Thus there is provided ample time for changing trucks without shutting down the machine. Together with the addition of the new twin clam gates, the increased hopper capacities permit operators to unload a uniform, non-segregated mix at a steady, profitable pace. **Pioneer Engineering Works, 1515 Central Ave., Minneapolis 13, Minn.**

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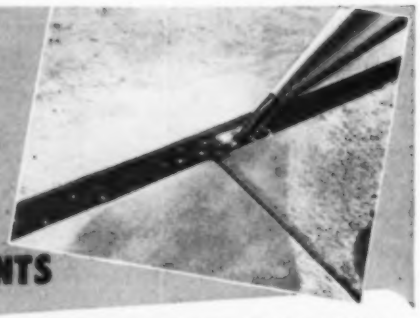

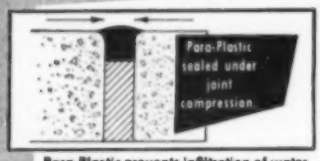

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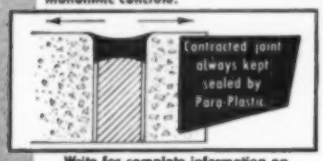

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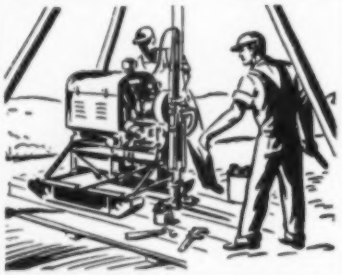

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Equipment, Materials & Methods (Continued)

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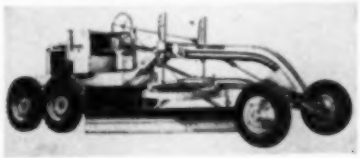

Mechanism for the front wheel lean includes axle and steering knuckles, additional tie bar, and wheel lean cylinder. The wheel lean has a range of 25 deg each way, comparable in design to that in the 104 hp Model AD-40 motor grader in the line. This gives ample range for ditching and for counteracting side draft. The power circle turn is operated by a hydraulic motor and reduction gear and includes a new circle. Self-cleaning teeth mounted on the outside of the circle, and self-locking reduction gears of the same design as on the AD-40 are used on the Model D. The new circle is designed to provide the same three-point mounting and provision for adjustment as on the standard Model D and other A-C motor graders. The circle turn provides precision control with a wide range of settings through its 135 deg. **Allis-Chalmers Mfg. Co., Tractor Div., Milwaukee, Wis.**

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Literature Available

HEAVY DUTY TRAILERS—Catalog C-7 describes the company's line of heavy duty trailers. Standard specifications, general specifications, photographs and informative data is included. **Birmingham Manufacturing Company, Inc., P. O. Box 1351, Birmingham, Ala.**

BUILDING IN THE ATOMIC AGE—The Proceedings of the Conference "Building in the Atomic Age", held at the Massachusetts Institute of Technology on June 16 and 17, 1952, have been published. The publication includes papers on the general effects of atomic bombs, the design and analysis of above and below ground structures, and the economics of blast resistant construction, which were presented by a group of leaders in this field of research. Price is $3.00 per copy, postpaid. **C. Marvin Pickett, Jr., Room 1-250, Mass. Inst. of Tech., Cambridge 39, Mass.**

DITCHERS—A catalog on the Shawnee ditcher (Model 52), the original back-hoe type ditcher designed specifically for light applications and the Scout ditcher (Model 66) designed for heavy and extensive digging, is available. Features are presented and photographs, specifications, etc., are included. **Shawnee Manufacturing Company, Inc., 1947 North Topeka, Topeka, Kansas.**

INCINERATION—A pamphlet on incinerator stokers will be of particular interest to those who are facing the problem of how to obtain increased capacity from their incinerators or taking steps to build new incinerator plants. F & E incinerator stokers have proven that they can increase the rated capacity of existing incinerators by 50% and, at the same time, greatly reduce labor, maintenance and carry-over and odors from the stack. **Flynn and Emrich Company, Holliday and Saratoga Sts., Baltimore 2, Md.**

ROTARY DISTRIBUTORS—Bulletin No. 5210 presents—to those who are faced with the problem—a means of purifying liquid influent that has received preliminary treatment for the removal of solids. Features of the Carter rotary distributor are described and illustrated and numerous charts, diagrams, specifications, etc., are included. **Ralph B. Carter Co., Hackensack, N. J.**

WIRE ROPE RECOMMENDATIONS—An informative 16-page wire rope recommendations booklet for general contractors, has been announced. Printed in two colors, and fully illustrated, this booklet was designed with a definite purpose in mind; that of recommending the "one best wire rope" for each major type of equipment used by contractors. **American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport, Conn.**

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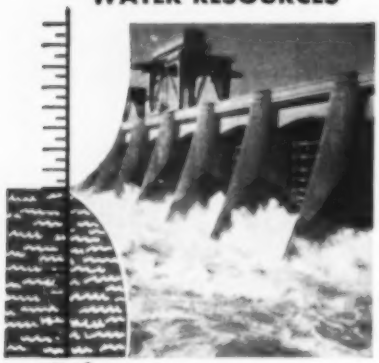

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Literature Available (Continued)

CARBON MONOXIDE DETECTOR—Bulletin 201 describes a carbon monoxide detector for protection wherever carbon monoxide threatens. Special features, functional description, components, specifications, suggested installations, etc., are included. **Taller & Cooper, Inc. 75 Front St., Brooklyn, N. Y.**

DRAWING AND DRAFTING SUPPLIES—A 60-page catalog describes a complete selection of drawing and drafting supplies. **The Alvin Company, Windsor, Conn.**

LIQUID AND GAS CONTROL—Measurement and control of liquids and gases for water and sewage works, power and process industries calls for compact equipment capable of performing exacting tasks. Equipment of this nature is described in a general catalog No. 003. The complete and well illustrated booklet containing 32 pages, lists many types of controllers, gauges, manometers, valves, venturi tubes, etc. Descriptions of the units, their operating characteristics, construction details, mountings, specifications and other data of interest to consulting plant engineers, purchasing engineers and operating personnel are listed. **Simplex Valve & Meter Co., 68th and Upland Sts., Philadelphia 42, Pa.**

WELDING ACCESSORIES—A welding accessories catalog which offers customers a complete line of such accessories and makes ordering and shipment a vastly speeded operation, has been issued. The "package buying" method offered by the 16-page catalog is backed up by speedy shipment from stock on the same day orders are received, the division reports. **A. O. Smith Corp., 3533 N. 27th St., Milwaukee 1, Wis.**

TRENCHLINER—The Model 250 Trenchliner is fully described in a 16-page catalog, attractively printed and illustrated to show in detail some of the Trenchliner features that provide greater production speeds and more versatile trenching operation. **Koehring Company, Milwaukee 16, Wis.**

COMPANY PUBLICATION—The first issue of the Rodney Hunt Machine Company's new house organ is now available. It will be published every other month. Editorially, it will attempt to treat each department of the business with one article in each issue, and carry some special story about Orange (Mass.) with which Rodney Hunt has been identified for 13 years more than a century. An article on the new bottom-seating sluice gate which improves flow characteristics is included in the publication. **Rodney Hunt Machine Co., Orange, Mass.**

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PROCEEDINGS AVAILABLE

The following papers, printed as Proceedings Separates, may be ordered on the basis of summaries given in this and previous issues of CIVIL ENGINEERING. Discussions of these papers will be received, as in the past, for a period of five months following the date of issue. A summary of each paper appears in several consecutive issues; other titles will be added every month, as they become available. Use the convenient order form on page 120.

Summarized in Earlier Issues

169. **Rating Curves for Flow over Drum Gates,** by Joseph N. Bradley.

170. **Rapid Computation of Flexural Constants,** by Thomas G. Morrison.

171. **Unified Mass-Transportation System for New York,** by William Reid.

172. **Aeronautical Charting and Mapping,** by Charles A. Schanck.

173. **Electronic Devices in Air Transport,** by F. B. Lee.

174. **Zoning Maps for Airports,** by Benjamin Everett Beavin, Sr.

175. **Design of Side Walls in Chutes and Spillways,** by D. B. Gumensky.

D-121. Discussion of Paper, **Rate of Change of Grade per Station,** by Clarence J. Brownell.

D-127. Discussion of Paper, **Stresses in Deep Beams,** by Li Chow, Harry D. Conway, and George Winter.

Third Notice

176. **Advances in Sewage Treatment and Present Status of the Art: Progress Report of the Committee of the Sanitary Engineering Division on Sewerage and Sewage Treatment.**

177. **Earthquake Stresses in Shear Buildings,** by M. G. Salvadori.

178. **Rainfall Studies Using Rain-Gage Networks and Radar,** by H. E. Hudson, Jr., G. E. Stout, and F. A. Huff.

179. **Stiffness Charts for Gusseted Members Under Axial Load,** by John E. Goldberg.

180. **A Direct Step Method for Computing Water-Surface Profiles,** by Arthur A. Ezra.

D-123. Discussion of Paper, **Long-Period Waves or Surges in Harbors,** by John H. Carr.

D-126. Discussion of Paper, **Variation of Wind Velocity and Gusts with Height,** by R. H. Sherlock.

D-128. Discussion of Paper, **Horizontally Curved Box Beams,** by Charles E. Cutts.

Second Notice

181. **Slackwater Improvement of the Columbia River,** by O. E. Walsh. Navigation on the Columbia River and its tributaries has for many years been of considerable importance to the economy of the basin. A description and history of this region are presented, and the slackwater improvements that have been made or authorized are brought to the attention of the profession. The effects of the improvements are analyzed, and conclusions as to their value are presented for discussion. (Available May 1.)

182. **Hipped Plate Analysis, Considering Joint Displacement,** by Ibrahim Gaafar. The study of hipped plates has omitted proper considerations of the effect that the relative displacements of the joints may have when determining stresses by the commonly accepted methods. The author shows how such an analysis can be corrected to give stress values that more closely conform to experimental results; and he indicates the magnitude of error possible if such a correction is ignored. The assumptions behind the author's theoretical development, and the experimental results that he presents should prove of great interest to the profession. (Available May 1.)

183. **Group Loadings Applied to the Analysis of Frames,** by I. F. Morrison. In an effort to decrease the time-consuming labor involved in analyzing highly indeterminate structures, the author presents the theory upon which rests the method of group loading. Group loadings are used for reducing a set of simultaneous equations to a set of one-term equations which are easily solved. The author indicates, in several examples, how the theory may be applied most effectively. This involves judicious choice of the primary structure at the start of computations. (Available May 1.)

184. **Dam Modifications Checked by Hydraulic Models,** by E. S. Harrison and Carl E. Kindsvater. A review of hydrologic and structural conditions pertaining to Bartlett's Ferry Dam, after the dam had been in service for twenty-five years, showed that major structural modifications were advisable. Chief among these was the addition of prestressed, reinforced concrete buttresses to the concrete spillway. Questions regarding the hydraulic characteristics of the modified spillway prompted the model studies described in this paper. Results of uplift measurements on the dam, a description of the structural modifications to the dam, and a description of the model tests are presented for discussion. (Available May 1.)

185. **Nonelastic Behavior of Bridges Under Impulsive Loads,** by S. J. Fraenkel and L. E. Grinter. For the case of simple-span bridges with deformations extending into the plastic range, the authors present a procedure for predicting the effects of bridge loads such as might be produced by an atomic explosion. Loads which vary with time and many other variables may be introduced into the problem. The particular loading studied is produced by a nominal atomic bomb vertically above midspan. Important considerations in determining the damage sustained are the span, the mass of the bridge, the deck elevation, and the type of structure. (Available May 1.)

186. **Settling Rates of Suspensions in Solids Contact Units,** by A. A. Kalinske. Accurate knowledge of the settling characteristics of various suspensions is of special importance in the upflow type of clarification equipment. The settling rates of various slurries, suspension, and sludges determine the permissable upflow rates in such units, and also the methods and equipment used in concentrating the sludge to be discharged from the units. For consideration and discussion by the profession, the author presents general information on the settling characteristics of various suspensions and demonstrates the application

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5. Discussions of each paper, with author's closure, also will be published as a Separate and must be ordered in the same manner as other Separates, except that no charge will be made for the discussions of a paper previously ordered. The order form will list available discussions of papers. Discussions will be numbered to agree with the basic paper.

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of these data to the design and operation of waste and waste treatment and clarification basins. (Available May 1.)

187. **The Equivalent Rectangle in Prestressed Concrete Design,** by John J. Peebles. In order to facilitate the design of prestressed concrete beams, the author presents a method whereby cross-sectional shapes and dimensions for such beams may be selected in a manner similar to that used for selecting structural steel shapes. The procedure is reasonably simple, and is based on the concept of a rectangular cross-section that has the same section modulus as that of the beam to be designed. This paper should help to stimulate new thought in a rapidly developing field. (Available May 1.)

188. **Laminar to Turbulent Flow in a Wide Open Channel,** by W. M. Owen. This paper presents theoretical equations for the velocity and rate of flow for laminar flow of fluids in rectangular channels and in channels of infinite width. Experimental data are studied relative to the determination of the critical value of the Reynolds number at which the flow changes from laminar flow to turbulent flow. Comparisons of experimental results with those obtained by theory are presented for discussion, and the transition range between true laminar flow and turbulent flow is examined. (Available May 1.)

D-135. Discussion of Paper, **Application of Electronic Flow Routing Analog,** by Max A. Kohler. The electronic stream-flow analog of the Weather Bureau was studied in the original paper, published in June, 1952. This analog was found effective for river forecasts where the Muskingum storage equation is applicable. The basis for the circuit used in the analog and the methods of operating the equipment were discussed briefly in the paper, together with an explanation of a basis for making analog routing more universally applicable. Discussers are: Alfred J. Cooper, and C. O. Clark. (Available May 1.)

D-136. Discussion of Paper, **Steady-State Forced Vibration of Continuous Frames,** by C. T. G. Looney. The original paper, published in June, 1952, described a method of analysis for the steady-state forced vibration of continuous frames. All members are considered as simply supported, and the geometrical discontinuity with adjacent members is corrected by means of a distribution procedure. Discussers are: E. F. Masur, A. S. Veletsos, and William A. Conwell. (Available May 1.)

First Notice

189. **Snow Hydrology for Multiple-Purpose Reservoirs,** by H. S. Riesbol. This paper presents criteria and examples of procedures followed, in their application to the determination of reservoir space allocations and spillway capacities. It brings to the attention of the profession those characteristics of snow that can be evaluated and applied to advantage, both from a hydrologic and an economic viewpoint, in the planning and design of multiple-purpose storage reservoirs. The writer explains that a gap exists between detailed physical knowledge of the processes of snow evaporation and melting and the application of this knowledge to practical design problems. (Available June 1.)

190. **Analysis of Corrective Actions for Highway Landslides,** by R. F. Baker. A semi-rational approach to the correction of highway earth-movement failures is presented in this paper. The analysis of these failures is based upon a classification system involving the mechanics of movement. A more general use of basic mechanics is used to estimate the effect of corrective measures and the control method selected is chosen not only for its effectiveness, but also for its economic feasibility. The analysis presented is semi-rational, and for general application extensive development and observations are still necessary. It is concluded that there is a need for a rational and scientific approach to the analysis of highway landslides. (Available June 1.)

191. **The Engineer's Role in Metropolitan Traffic Planning,** by Lloyd Braff. Successful community growth depends considerably on effective long-range traffic planning. The engineer must not only organize and apply traffic studies and design the required highway systems, he must also be active in coordinating the work of the various branches of city government affected by the work. This paper describes the problems involved and cites the work in Dallas, Tex., as an example of the proper approach to solving such problems. (Available June 1.)

192. **Relief Well Systems for Dams and Levees,** by W. J. Turnbull and C. I. Mansur. Excessive seepage and sand boils occur frequently during high water where dams or levees are underlain by strata of pervious sands and gravels. This paper presents the results of an investigation in which sand models were used to study the following: (1) The phenomena of underseepage; (2) the use of pressure relief wells as a means of controlling underseepage and sand boils along the lower Mississippi River levees; (3) the operation of relief wells; (4) the well and seepage flows; and (5) the landward substratum pressures with and without relief wells in operation, for various foundations, seepage entrances, and top strata. The conditions studied were those considered to represent qualitatively conditions commonly encountered in the lower Mississippi River valley. (Available June 1.)

193. **Velocity Measurement of Air-Water Mixtures,** by L. G. Straub, J. M. Killen, and O. P. Lamb. The insufflation of air into high flow-velocity streams of water is one of the many fluid mechanics phenomena still retarded in its complete analytical explanation by the inadequacy of instrumentation required for experimental observation. This paper traces the development and use of a velocity measuring instrument at the St. Anthony Falls Hydraulic Laboratory. The meter is used in conjunction with a cathode-ray tube and is most satisfactory for laboratory investigations. Studies indicate that the instrument might be used for turbulence measurements and velocity measurements of fluid mixtures other than water, and that a portable model may be adaptable to field conditions. (Available June 1.)

D-129. Discussion of paper, **Analysis of Arch Dams of Variable Thickness,** by W. A. Perkins. The original paper, published in May 1952, related the difficulties in determining the stresses for an arch thicker at the abutment than at the crown. Formulas and curves were presented to simplify the process of determining these stresses. Discussers are: Alfred L. Parme, L. J. Mensch, Fairfax D. Kirn and Gurmukh S. Sarkaria, A. C. Josephs, G. E. Goodall, and W. A. Perkins. (Available June 1.)

D-138. Discussion of paper, **The Value and Administration of a Zoning Plan,** by Huber Earl Smutz. In the original paper, which was published in July 1952, twentieth century progress in city planning and zoning was discussed with particular reference to zoning. Discussers are: Henry Horowitz, and Huber Earl Smutz. (Available June 1.)

D-145. Discussion of paper, **Torsion of I-Type and H-Type Beams,** by John E. Goldberg. In the original paper, published in August 1952, a review of torsion of I-Type and H-Type sections, the basic differential equation for the twisting of such sections, and particular solutions of the differential equation were presented with reference to various problems, including that of a framed floor panel. Discussers are: Kurt H. Gerstle, and John E. Goldberg. (Available June 1.)

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Index to Advertisers

Acker Drill Company, Inc. 92
Aero Service Corporation 69
Alan Wood Steel Company 88
Albert Pipe Supply Co., Inc. 107
Allied Structural Steel Companies 98
Allis-Chalmers Manufacturing Company . . . . . 5 and 9
American Association Of State Highway Officials 118
American Bitumuls & Asphalt Company 6
American Concrete Pipe Association 20
American Concrete Pressure Pipe Association 10
Arkwright Finishing Co. 86
Armco Drainage & Metal Products, Inc. 83
Austin-Western Company 93

Barber-Greene Company 11
Bethlehem Steel Company 22
Bludworth-Marine, Div. of National-Simplex-Bludworth, Inc. 99
Boeing Airplane Company 103
Borden & Riley Paper Co. 115
Brown & Brown, Inc. 117
Bucyrus-Erie Company 7

Cast Iron Pipe Research Association . . . . . 14 and 15
Caterpillar Tractor Co. . . . . 12 and 13
Cement Gun Company 106
Centriline Corporation 108
Chicago Bridge & Iron Company 17
Chicago Pump Company 4
Columbia-Geneva Steel Division . . . . . 104 and 105
Concrete Reinforcing Steel Institute 99

Drilled-In Caisson Corporation 107

Eagle Pencil Company 113
The Earle Gear & Machine Company 114

L. B. Foster Co. 21

General Electric Co. 19
Giles Drilling Corporation 26
W. & L. E. Gurley 75

Hardinge Company, Incorporated 112
Rodney Hunt Machine Co. 61

Imperial Pencil Tracing Cloth 99
Ingalls Iron Works Company 55
International Harvester Company . . . . . 96 and 97
Irving Subway Grating Co., Inc. 117

Keuffel & Esser Co. . . . . 99, 100 and 101
Koppers Company, Inc. 112

Laclede Steel Company 94
Layne & Bowler, Inc. . . . . 3rd cover
Leupold & Stevens Instruments, Inc. 118
The Lincoln Electric Company 81
Lock Joint Pipe Company . . . . . 4th cover
Lone Star Cement Corporation 24
The Lufkin Rule Co. 90

MacArthur Concrete Pile Corp. 117
Mayo Tunnel & Mine Equipment 95
Moretrench Corporation 18

National Clay Pipe Manufacturers, Inc. 1
Naylor Pipe Company 84

The Permutit Company 79
Phoenix Bridge Company 117
Pittsburgh-Des Moines Steel Co. 8
Pressure Concrete Co. 92
Proportioneers, Inc. 2

Raymond Concrete Pile Co. . . . . 2nd cover
Paul Reinhart & Co., Inc., Kern Instrument Division 115

Sauerman Bros., Inc. 106
Servicised Products Corp. . . . . 90 and 116
Simplex Valve & Meter Company 85
S. Morgan Smith 109
Solvay Process Division, Allied Chemical & Dye Corporation 95
Sonoco Products Company 91
Spencer, White & Prentis, Inc. 114
Sprague & Henwood, Inc. 116
Superior Concrete Accessories, Inc. 16

Taller & Cooper, Inc. 89
Tennessee Coal & Iron Division . . . . . 104 and 105

Union Metal Manufacturing Company 23
United States Pipe & Foundry Co. 3
United States Steel Corporation . . . . . 104 and 105
United States Steel Export Company . . . . . 104 and 105
Universal Concrete Pipe Co. 111

Wallace & Tiernan Products, Inc. 95
Western Foundation Corporation 77
David White Company 87
Henry Wild Surveying Instrument Supply Co. of America, Inc. 111

Professional Services 121, 122, 123

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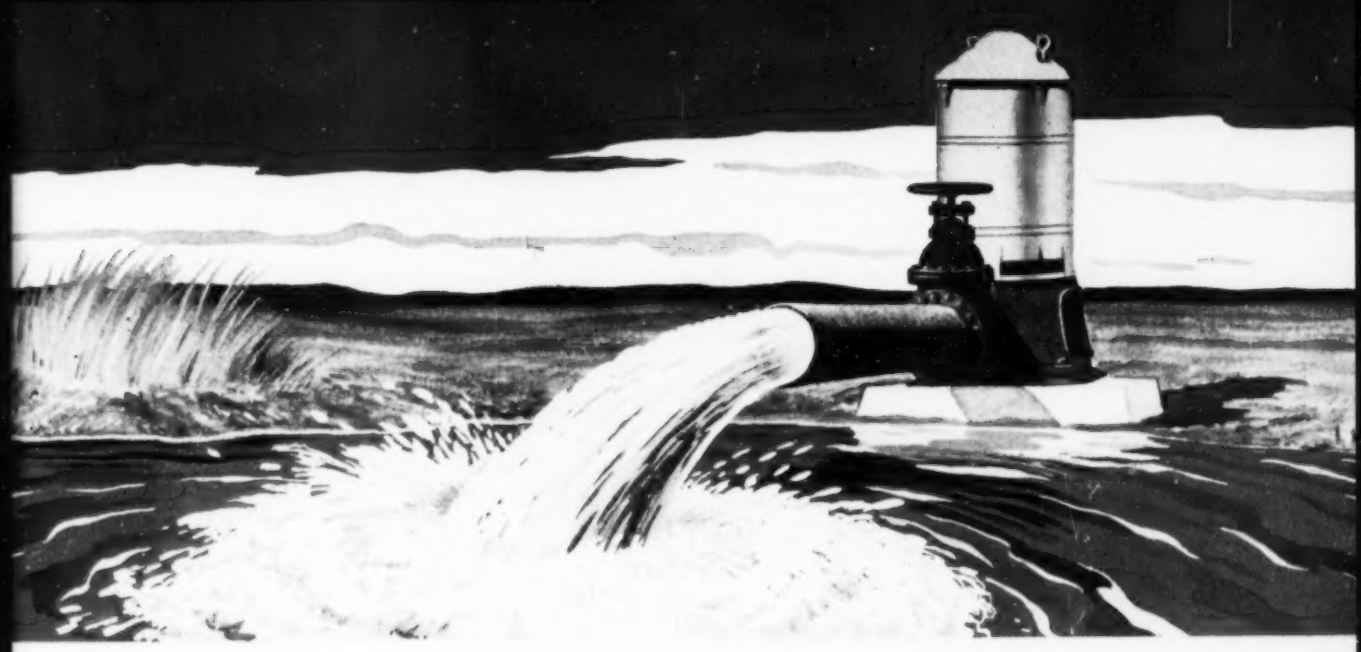

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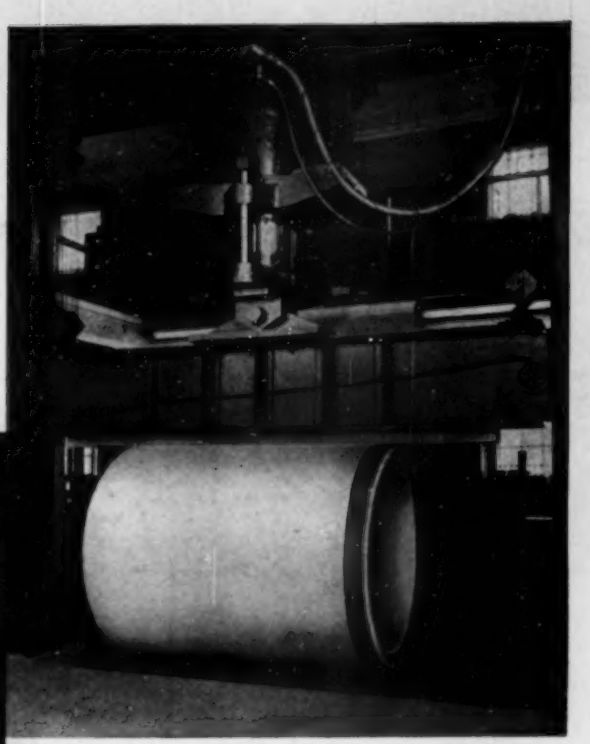

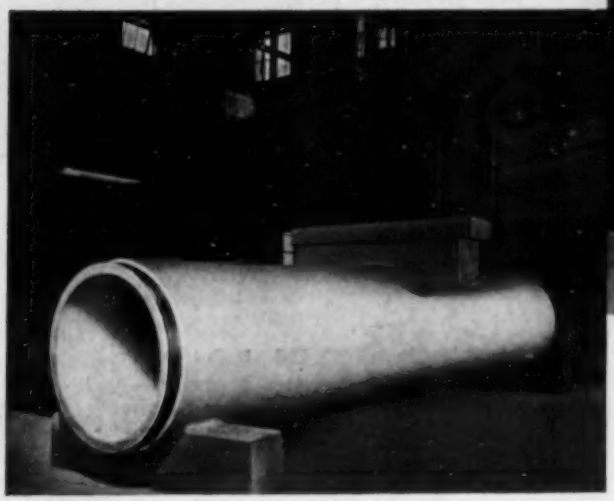

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